M.Sc. Zoology Previous Practical File (VMOU) Session July-2022 (Camp Sep.-Dec. 2024)

INDEX

22. Chiton (Sea myca)
23. Pila globosa
24. Loligo (Squid)
25. Nautilus
26. Dentalium
27. Aplysia
28. Mytilus
29. Pinctada vulgaris
30. Octopus

ECHINODERMATA

31. Asterias
32. Holothuria
33. Antedon
34. Echinus

HEMICHORDATA

35. Balanoglossus

✓ SLIDES

PROTOZOA

36. Vorticella

PORIFERA

37. Sponge gemmule

COELENTERATA

38. Obelia

ANNELIDA

39. Nereis: parapodium
40. Earthworm : T.S. passing through pharynx

PROTOZOA

41. Euglena
42. Paramecium
43. Nyctotherus

PORIFERA

44. Sycon- L.S.

PLATYHELMINTHES

45. Fasciola hepatica - T.S. passing through testes
46. Taenia solium - Scolex w.m.

ANNELIDA

47. Leech - T.S. passing through crop region
48. Earthworm - Setae

MOLLUSCA

49. Unio : T.S. passing through Gills

ARTHROPODA

50. Odontotermes (Termite)
51. Daphnia

PLATYHELMINTHES

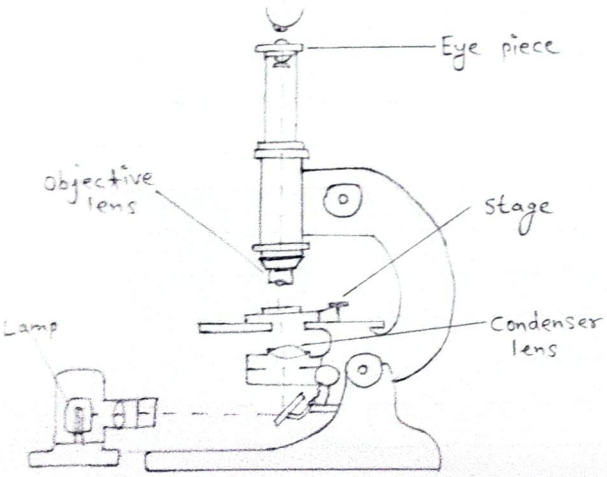
52. Fasciola hepatica : Redia larva
53. Fasciola hepatica : Cercaria larva

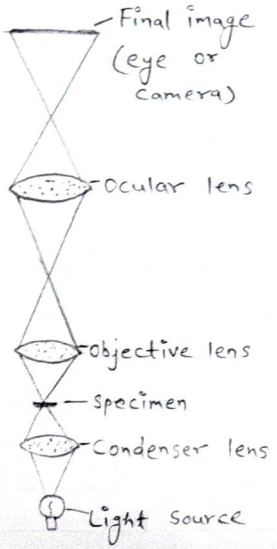
54. Biostatistics - Mean, Mode, Median & Chi- Square test

55. Biochemistry - Benedict's test, Fehling's test, Biuret test, Xanthoproteic test

56. Blood physiology

57. Cell biology - mitosis





Compound Microscope

24/05/

Compound Microscope

Page No.
Date

Compound Microscope:-

The light microscopy is to shine light through a specimen and examine it under magnification. The major optical parts of a compound microscope are:-

1. Objective lens:- It functions to magnify the object.
2. The eyepiece delivers this image to the eye.
3. The condenser focuses the light source on the specimen.
4. The light source illuminates the specimen. The best light source is one in which the light intensity is controlled by adjusting the voltage.

Sample Preparation:-

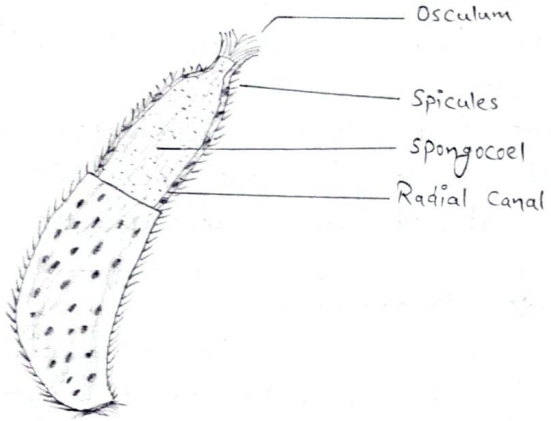
Specimens can be examined by simply placing them under microscope. However, it is necessary to prepare and stain.

(i) Fixation:- By this process cells are preserved and stabilized. Common fixatives: formaldehyde, acids etc

(ii) Sectioning:- Thick samples such as tissues need to cut into thin sections.

(iii) Staining:- The image generated by microscopy depends upon different components in the sample interacting with the impeding the light waves differently. Biological samples are fairly homogenous and do not greatly impede light. Therefore, it is often necessary to stain cell with dyes.

Phylum – Porifera
class – Calcarea
Order – Heterocoela
Genus – Sycon



Sycon – with a portion of body removed to show spongocoel

Sycon (Scypha)

Page No.
Date

Classification :–

Phylum – Porifera, pore bearing animals, diploblastic with Cavity Spongocoel

class – Calcarea, spicules calcareous, canal system asconoid / syconoid / leuconoid type

Order – Heterocoela, Canal system syconoid type

Genus – Sycon

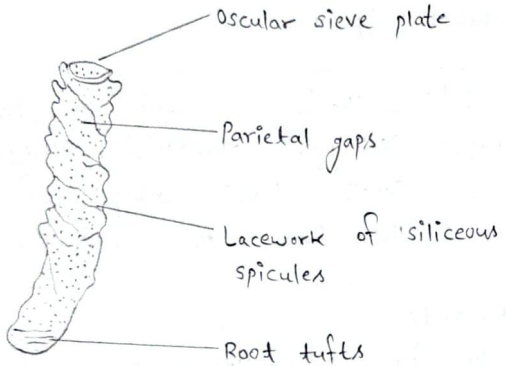
Habitat :– Marine, found in shallow water.

Habit :– Although clustered, they are more independent. Small buds may occasionally appear at the base of mature specimens.

Characters :–

1. Body is vase-like, more or less separate at the base. The base is attached to the substratum and the distal free end bears an opening called osculum.
2. Osculum is surrounded by large monoaxon spicules, forming a collar around it.
3. The external surface reveal the presence of numerous pores called ostia, these are incurrent pores permitting entry of water.
4. Due to folding of the body covering numerous canals are formed called incurrent canals and radial canals.
5. Internal cavity is spongocoel.

Phylum - Porifera
Class - Hexactinellida
Order - Hexasterophora
Genus - Euplectella



Euplectella

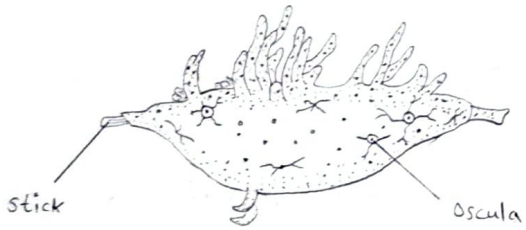
Euplectella

Classification :-
Phylum - Porifera, pore bearing animals, diploblastic with cavity spongocoel.
Class - Hexactinellida, spicules silicious, triaxen hexactine six rayed.
Order - Hexasterophora, spicules hexaster.
Genus - Euplectella

Habitat :- Marine, inhabit deep water at a depth of 500-5000 meter below the surface of sea.
Habit :- Solitary

Characters :-
1. It is glossy and shaped as elongated curved basket.
2. It is commonly called 'Venus's flower basket'.
3. Six rayed silicious spicules are symmetrically arranged and join to form network with parietal gaps.
4. The basal part consists of long glassy spicules which collectively form the tuft. The tuft serves to fasten the sponge to muddy ooze of sea bottom.
5. The osculum is covered by an oscular sieve plate.
6. The canal system of syncoid type, choanocytes are restricted to flagellated chambers.

Phylum - Porifera
Class - Demospongiae
Order - Monoaxonida
Genus - Spongilla



Spongilla - Colony

Spongilla

Page No.
Date

Classification:-

Phylum- Porifera, Pore bearing animals, diploblastic with cavity spongocoel

class- Demospongiae, skeleton of silicious spicules and spongin fibers or absent

Order- Monoaxonida. spicules are monoaxon and silicious spongin fibres may be present or absent

Genus- Spongilla

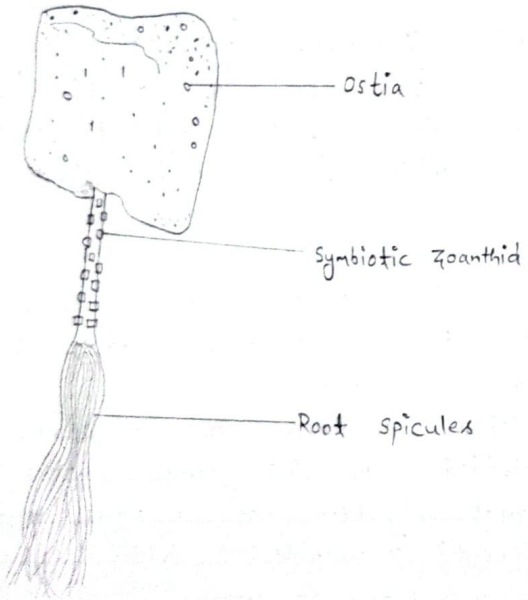
Habitat:- Inhabits fresh water ponds and lakes and is commonly called 'Fresh water Sponge'.

Habit:- Colonial, profusely branched colony is associated with twigs and plant sticks.

Characters:-

1. Body is covered with thin dermal membrane.
2. The body consists of several dermal ostia and osculum.
3. Skeleton consists of monoaxon silicious spicules embedded in the mesh work of spongin fibres
4. Canal system of rhagon type. Course of water current: prosopyle → flagellated chambers → apopyle → spongocoel → osculum.
5. Asexual reproduction under unfavourable conditions by gemmule formation.
6. Free swimming larva characteristic of Spongilla settles to twigs.

Phylum - Porifera
Class - Hexactinellida
Order - Amphidiscophora
Genus - Hyalonema



Hyalonema

Hyalonema

Page No.
Date

Classification:-

Phylum - Porifera, pore bearing animals, diploblastic with cavity spongocoel

Class - Hexactinellida, Spicules silicious, triaxon hexactive six rayed.

Order - Amphidiscophora, special type of microsclere: amphidiscs are rat like spicules

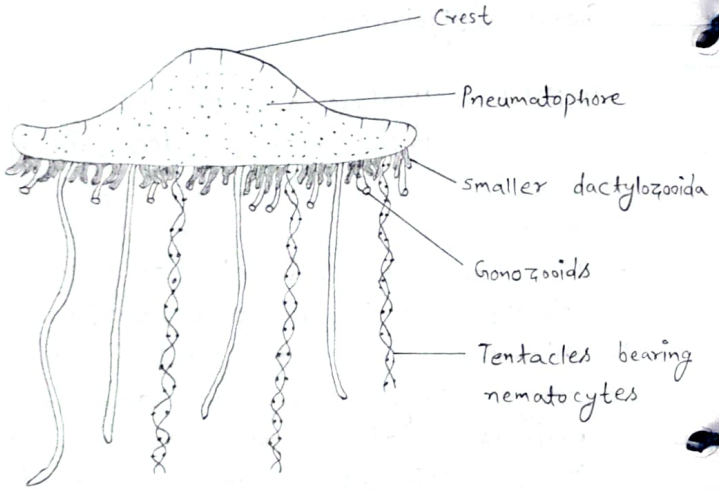
Genus - Hyalonema

Habitat:- Hyalonema is a marine form found 10-15 meters deep in sea.

Characters:-

1. It has a rounded or oval body with a spirally twisted root tuft.
2. Spicules of root tuft continue through the sponge body as an axis or columella and projects above as a gastral cone.
3. Root spicules are compact, stalk-like and twisted giving the appearance of a rope.
4. Middle part of columella has symbiotic polyps.
5. Skeleton consists of small amphidisc spicules which are siliceous in nature.
6. Extending from all over the surface are small, branching, five-rayed spicules.

Phylum - Coelenterata
Class - Hydrozoa
Order - Siphonophora
Genus - Physalia



Physalia

Physalia

Page No.
Date

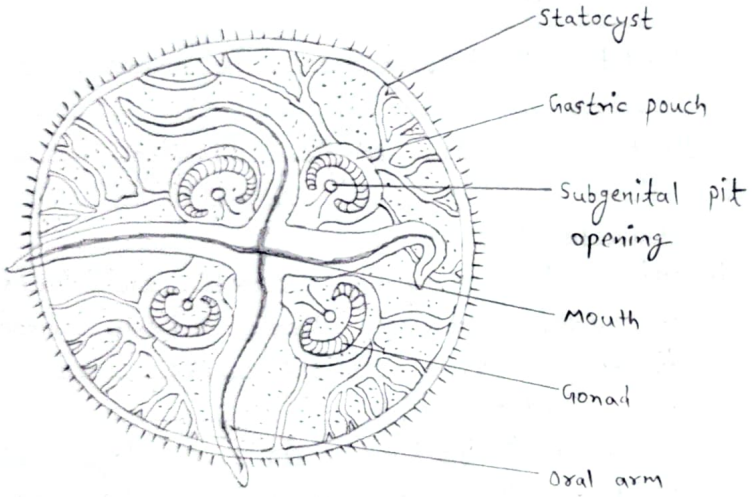
Classification:-
Phylum - Coelenterata, presence of coelenteron, tissue grade of organisation, diploblastic.
Class - Hydrozoa, polyp and medusa are present.
Order - Siphonophora, Polyp and medusa forms show polymorphism.
Genus - Physalia

Habitat:- Marine, found in warm waters.

Habit:- Colonial, pelagic floating form.

Characters:-
1. This is commonly called as 'Portuguese man of war', because they suddenly appear and disappear from water like the warrior ships of Portuguese.
2. Prominent feature is a large bladder like float - the pneumatophore, filled with gases.
3. On the upper surface of pneumatophore is a sail like crest.
4. Gastrozoids - feeding zooids, Small and large dactylozooids - for defence, gonadendra for reproduction
5. The nematocysts on tentacles are highly poisonous. Commensal small Nomeus fish lives among the tentacles without any harm.

Phylum - Coelenterata
Class - Scyphozoa
Order - Semaeostomeae
Genus - Aurelia



Aurelia

Aurelia

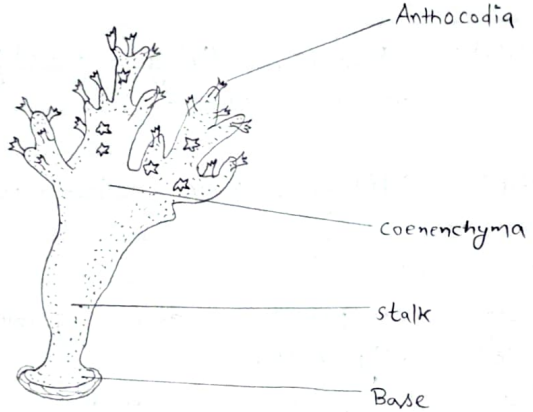
Classification:-
Phylum - Coelenterata, presence of coelenteron, tissue grate of organization, diploblastic.
Class - Scyphozoa, medusa is dominant.
Order - Semaeostomeae, medusae saucer shaped and provided with oral lobes.
Genus - Aurelia

Habitat:- Marine, living mostly in coastal warm waters.

Habit:- Solitary, free swimming.

Characters:-
1. Being transparent and gelatinous are commonly called 'Jelly-fish'.
2. Body is saucer shaped or umbrella shaped with two surfaces (a) convex - exumbrellar surface (b) Concave - Subumbrellar surface.
3. The circular margin has eight notches.
4. Each notch has a pair of marginal lappets which encloses sense organs tentaculocyst or rhopalium.
5. The animal is carnivorous.
6. The animal swims by rhythmic contraction of muscular processes of cells of umbrellar surface.
7. Development indirect - ephyra larva is formed.

Phylum – Coelenterata
class – Anthozoa
Order – Alcyonacea
Genus – Alcyonium



Alcyonium – colony

Alcyonium

Page No.
Date

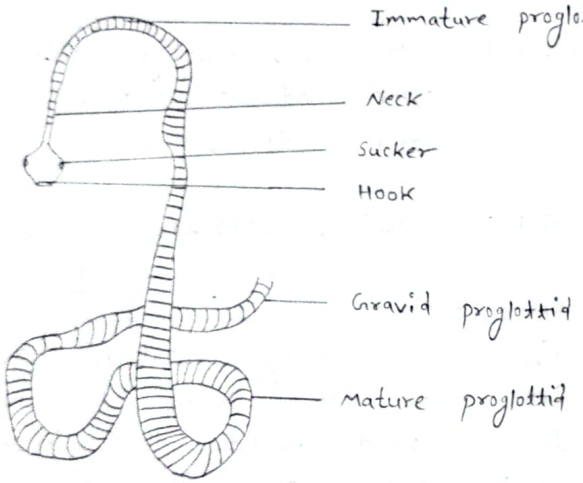
Classification:-
Phylum- Coelenterata, presence of coelenteron, tissue grade of organisation, diploblastic
Class- Anthozoa, only polyp stage.
Order- Alcyonacea, Basal part forms fleshy mass.
Genus- Alcyonium

Habitat:- Marine, mostly found in the tidal zone at a depth of 200m in temperate and cold sea.

Habit:- Colonial, sedentary.

Characters:-
1. This is commonly called "Dead man's finger."
2. Base of the colony is meant for adherence to substratum. At the free end of the stalk there are branched leathery lobes.
3. Over the stalk is fleshy collenchyma from which project out the polyp with oral end.
4. Skeleton of spicules provide rigidity to collenchyma.
5. Eight pinnate tentacles are present in each polyp.
6. Fertilization occurs outside the body
7. In life cycle free swimming planula larva is formed.

Phylum - Platyhelminthes
Class - Cestoda
Order - Cyclophyllidea
Genus - Taenia



Taenia

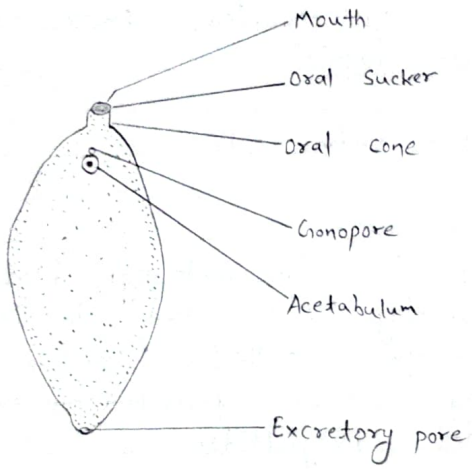
Taenia Solium

Classification:-
Phylum - Platyhelminthes. (Acoelomate, tissue grade of organisation, triplablastic, billaterally symmetrical)
class- Cestoda. (Endoparasites commonly called tapeworm)
order- Cyclophyllidea, (Scolex with four suckers)
Genus- Taenia

Habit:- Endoparasite

characters:-
1. Body is dorsaventrally flattend, long, ribbon like measuring 2-3 metre in length.
2. Commonly called 'tapeworms'.
3. Body shows pseudometamerism with segments called proglottids.
4. Body division:-
(a) Scolex - with two circles of rostellar hooks and four suckers (meant for adhesion)
(b) Neck region - Zone of growth or zone of proglottization
(c) Immature proglottids - About 200 proglottids.
(d) Mature proglottids - 500 in number with reproductive organs.
(e) Gravid proglottids - About 200 proglottids. They contain only branched uterus with fertilised eggs.
5. Life cycle: Digenetic - involves two hosts.

Phylum – Platyhelminthes
Class – Trematoda
Order – Digenea
Genus – Fasciola



Fasciola hepatica

23/07/24

Fasciola hepatica

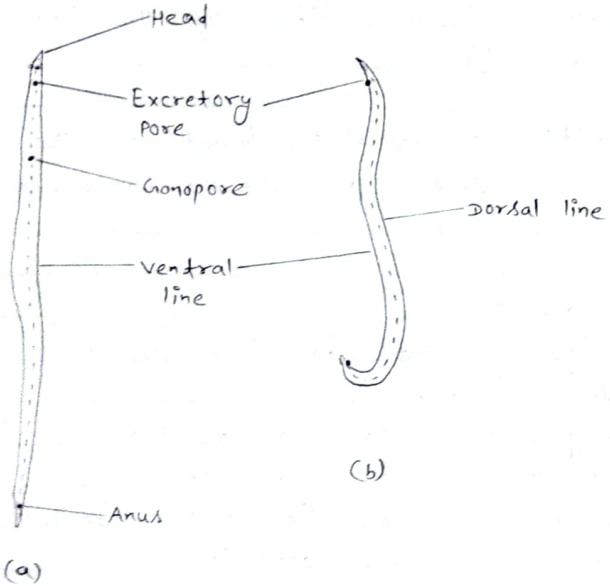
Page No.
Date

Classification :-
Phylum – Platyhelminthes, (Acoelomate, tissue organ grade of organisation, triploblastic, bilaterally symmetrical)
Class – Trematoda, (Parasites commonly called flukes due to leaf like body)
Order – Digenea, (Life cycle includes two hosts)
Genus – Fasciola

Habit :- Endoparasite, found in the bile ducts of liver of sheep, human, monkey, horses and dogs.

Characters :-
1. Being present in liver it is commonly called "liver fluke".
2. Body measures about 2-5 cm in length and 0.5 - 1.5 cm in breadth.
3. Body is leaf like with anterior end shaped like a cone called cephalic cone.
4. At the end of the cephalic cone is a mouth encircled by sucker called oral sucker.
5. Midventrally about 3-4 mm posterior to oral sucker there is large ventral sucker or acetabulum.
6. In front of ventral sucker there is a small opening called genopore.
7. Alimentary canal lacks anus.

Phylum - Aschelminthes
Class - Nematoda
Order - Ascaroidea
Genus - Ascaris



Ascaris lumbricoides: (a) Female (b) Male

29/09/22

Ascaris lumbricoides

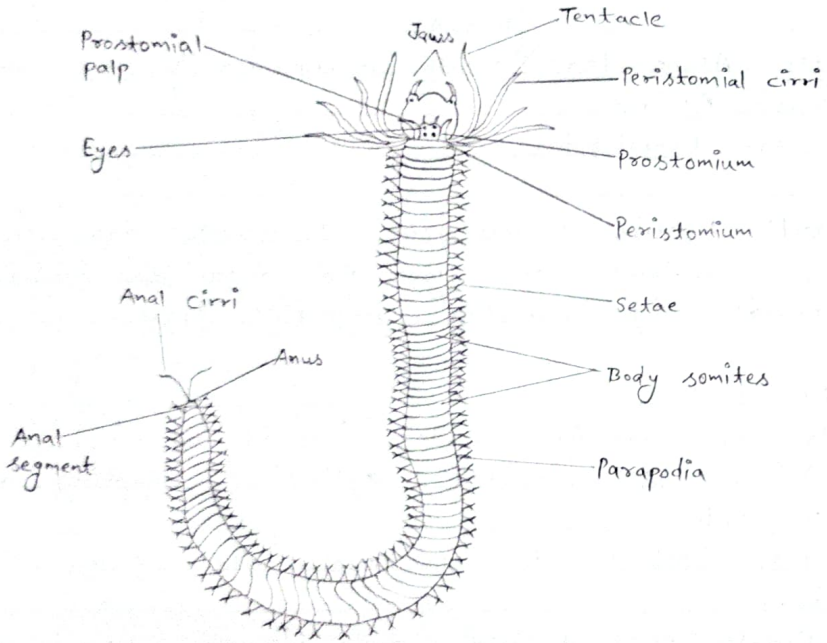
Page No.
Date

Classification:-
Phylum - Aschelminthes (Unsegmented, triploblastic, bilaterally symmetrical, pseudocoelomate)
Class - Nematoda (thread like forms or round worms)
Order - Ascaroidea (mouth surrounded by three lips)
Genus - Ascaris
Species - lumbricoides

Habit:- Ascaris lumbricoides is endoparasite of intestine of pigs and man. The infection spreads by ingesting infective eggs.

Characters:-
1. It is commonly called 'round worm'.
2. Animal is elongated cylindrical tapering at the end.
3. The animal is unisexual with sexual dimorphism.
4. Female is straight and longer, male is curved at the posterior end and smaller.
5. Body colour is yellowish white.
6. Mouth is at the anterior end, surrounded by three lips.
7. The animal is pseudocoelomate.
8. Life cycle is monogenetic, completed in man.

Phylum - Annelida
class - Polychaeta
Order - Errantia
Genus - Nereis



Nereis

Nereis

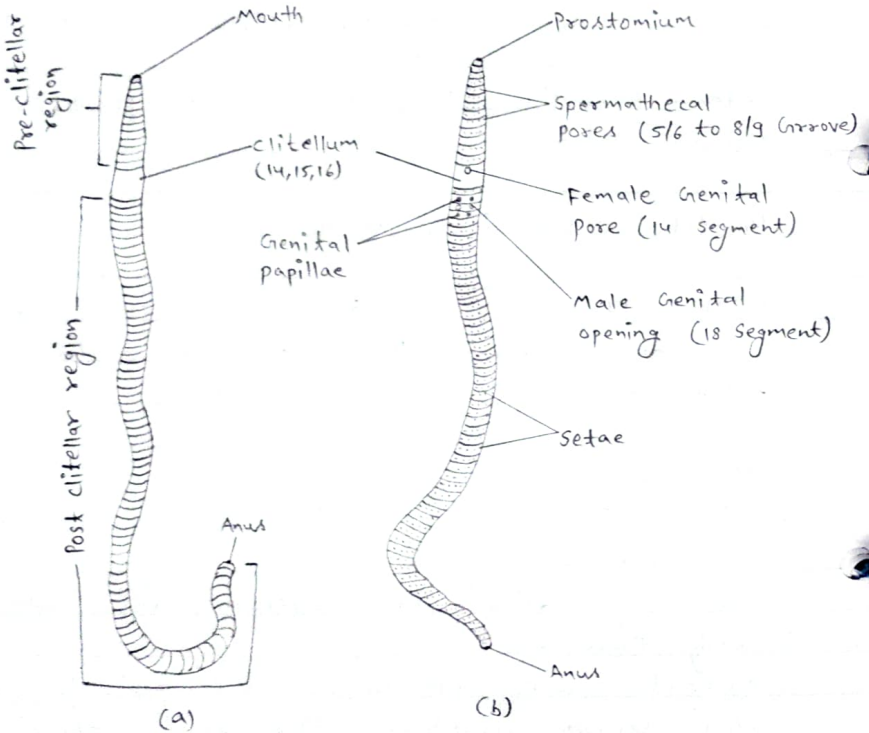
Classification:-
Phylum - Annelida (Metameric segmentation, schizocoelom present, bilateral symmetry)
Class - Polychaeta (Numerous setae are present, Clitellum absent, development indirect - trochophore larva)
Order - Errantia (locomotion by parapodia, swarming animals)
Genus - Nereis

Habitat - cosmopolitan, marine

Habit - It is found burried in sand and found among clams though the animal has no ecological relationship with sand or clams.

Characters:-
1. This animal is commonly called Sandworm or clamworm or ragworm.
2. The segmentation is external and internal.
3. Body division:-
(i) Head:- with prostomium and peristomium. The head has sensory structures like eyes, prostomial tentacles, palps and nuchal organs
(ii) Trunk - with 80-120 segments, each with a pair of lateral parapodia.
(iii) Pygidium - last segment with terminal anus and a pair of anal cirri.
4. Animal is carnivorous, filter feeder and raptorial.

Phylum - Annelida
Class - Oligochaeta
Order - Opisthopora
Genus - Pheretima



Pheretima : (a) Dorsal view (b) Ventral view

Pheretima

Page No.
Date

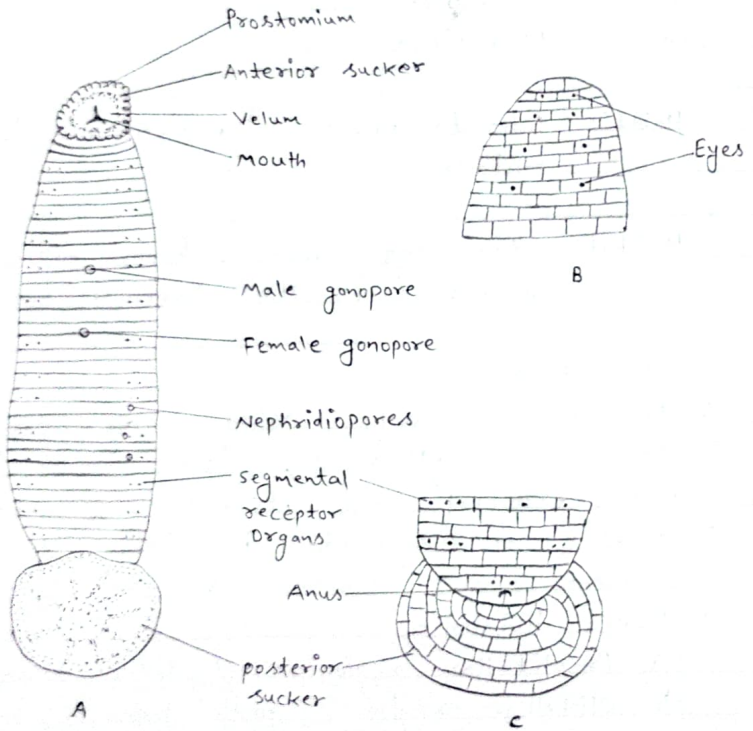
Classification:-
Phylum - Annelida (Metameric segmentation, bilateral symmetry, Schizocoelom present)
Class - Oligochaeta (few setae are present in segments, clitellum present, development direct)
Order - Opisthopora
Genus - Pheretima

Habit:- Inhabits moist soil, rich in decaying organic matter.

Habitat:- Burrowing forms, form pellets at the opening of the burrows, nocturnal.

Characters:-
1. It is commonly called as 'earthworm'.
2. Body is cylindrical, dark brown in colour with external and internal segmentation.
3. Number of segments in body is 100-120 and segments are homonomous.
4. Body division:-
   a. Preclitellar region - 1 to 13 segment.
   b. Clitellar region - girdle like in 14, 15, 16 segments.
   c. Postclitellar region - 17 to last segment.
5. Each segment except first, clitellar and last segment has a ring of setae bearing 80-100 setae.
6. On ventral side of 14th segment has a female genital pore.

Phylum - Annelida
Class - Hirudinea
Order - Gnathobdellida
Genus - Hirudinaria



Hirudinaria: (A) Ventral view (B) Anterior dorsal view (C) Posterior dorsal view

Hirudinaria

Page No.
Date

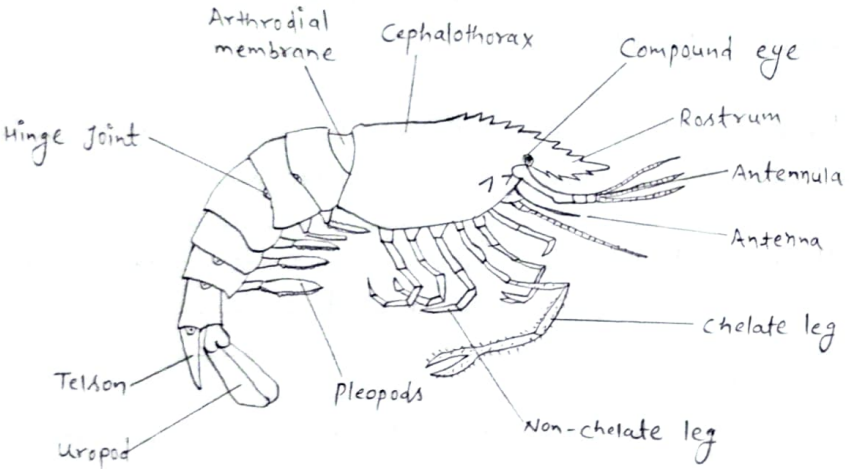
Classification:-
Phylum - Annelida (Metameric segmentation, bilateral symmetry, schizocoelom present)
Class - Hirudinea (Includes parasitic leeches, clitellum is temporary, development direct)
Order - Gnathobdellida (Jaws are present, proboscis is not protrusible)
Genus - Hirudinaria

Habit:- Leech is ectoparasite of fish, frog, cattles and man. It is sanguivorous.

Habitat:- Found in freshwater ponds, lakes, swamps and slow running streams.

Characters:-
1. Commonly known as 'Indian common leech'.
2. Body is soft, elongated and vermiform, dorsoventrally flattened. The body has great power of contraction and expansion.
3. The body has 33 segments and each segment is divided into annuli. The number of annuli varies in segments.
4. The body bears two suckers. At the anterior end is oral sucker. At the posterior end there is anal sucker.
5. Mouth is triradiate, ventral.
6. Ocelli are five pairs located dorsally.

Phylum - Arthropoda
Subphylum - Mandibulata
Class - Crustacea
Order - Decapoda
Genus - Palaemon



Palaemon

Palaemon

Date __/__/____
Page _____

Classification:-

Phylum - Arthropoda (Animal bears jointed appendages, triploblastic, bilaterally symmetrical)

Subphylum - Mandibulata (Mouth parts with mandibles. Six segmented head with one or two pairs of antennae.)

Class - Crustacea (Head with two pairs of antennae.)

Order - Decapoda (Five pairs of thoracic walking legs are present.)

Genus - Palaemon

Habitat:- Freshwater free moving form, inhabits streams, ponds, lakes, rivers.

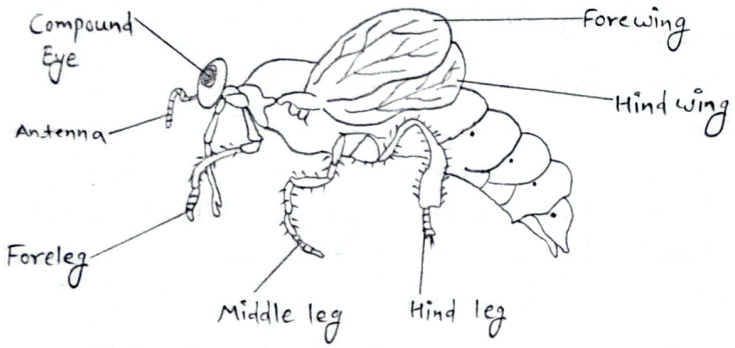
Habit:- Nocturnal, omnivorous.

Characters:-

1. The animal is commonly called 'Prawn'.
2. Colour is pale ~~greith~~ greenish with brown patches.
3. Body is spindle shaped, elongated, measuring 20cm in length.
4. Body division:-
   (i) Cephalothorax :- formed by fusion of 6 segmented head and 8 segmented thorax, which are covered by a carapace.
   (ii) Abdomen in laterally compressed and curved ventrally, the animal look like comma. It is five segmented, abdomen has five pairs pleopods or swimmerets and one pair of uropod. The abdomen ends in telson.

Teacher's Sign .....

Phylum- Arthropoda
Class- Insecta
Order- Hymenoptera
Genus- Apis



Apis indica

Apis indica

Page No.
Date

Classification:-

Phylum - Arthropoda (Animal bears jointed appendages, triploblastic, bilaterally symmetrical)

Subphylum - Mandibulata (Mouth parts with mandible. Six segmented head with one or two pairs of antennae.

Class - Insecta (Thorax with 3 pairs of appendages)

Order - Hymenoptera (Mouth parts biting, chewing, lapping and sucking type. wings two pairs)

Genus - Apis

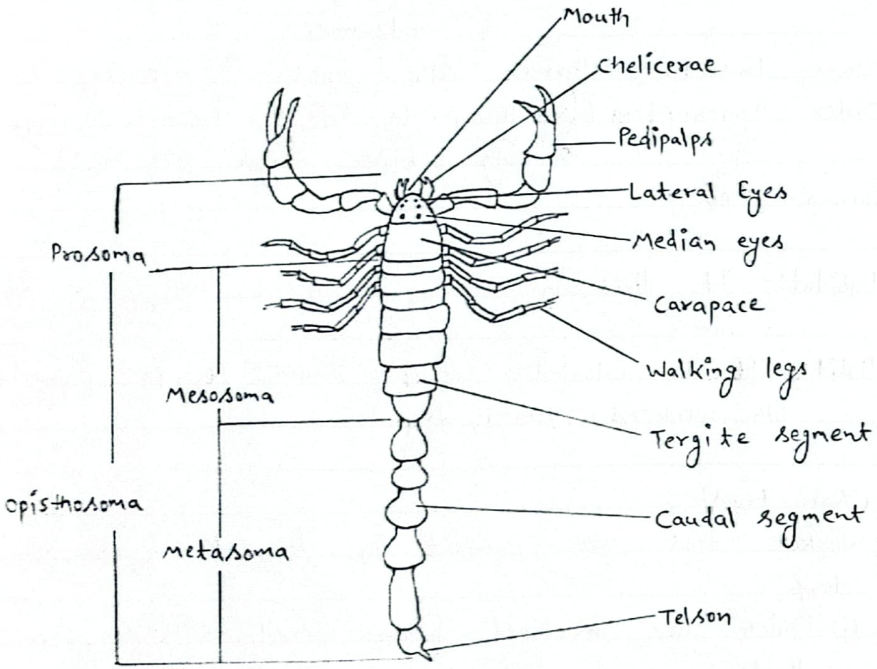
Habitat:- It lives in highly organised colony in bee hive.

Habit:- It is colonial, social insect. It is polymorphic with workers, queen, drones.

Characters:-

1. Worker bees are present in largest number in the colony.
   (i) which are developed from fertilized eggs. Size is smallest.
2. The queen is larger in size having longer abdomen mates once in life and lays eggs only.
3. The drones are fertile males, without sting, developed parthenogenetically, copulates with queen and then dies.
4. The honey bees are economically important insects produce - honey and bee wax and helpful in pollination of flowers.

Phylum - Arthropoda
class - Arachnida
order - Scorpionida
Genus - Palamnaeus



Palamnaeus

Palamnaeus

Page No.
Date

Classification:-

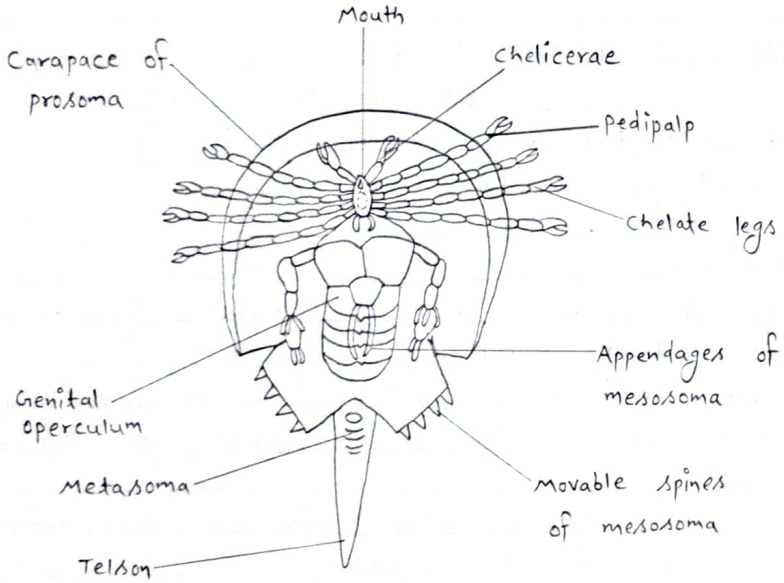
Phylum - Arthropoda (Jointed Appendages, Bilateral symmetry)
Subphylum - Chelicerata
Class - Arachnida (4 pair of legs)
Order - Scorpionida
Genus - Palamnaeus

Habit and Habitat:- Scorpions are of wide occurrence but are largely restricted to tropical and subtropical areas of the world. They are especially abundant in deserts.

Characters:-

1. Body of scorpion is long, narrow, segmented and dorso-ventrally flattened.
2. Colour varies from shining black to pale yellow.
3. Dorsal surface is usually darker than the ventral surface.
4. Body is covered with chitinous exoskeleton. It is made of 18 segments.
5. Anterior prosoma or cephalothorax is broad and formed by the fusion of head with thorax.
6. Posterior opisthosoma or abdomen is long and narrow.
7. Genital aperture is situated mid-ventrally on the first segment of mesosoma, covered by the genital operculum.

Phylum – Arthropoda
Class – Merostomata
order – xiphosura
Genus – Limulus



Limulus

Limulus

Date __/__/____
Page _____

Classification:-
Phylum – Arthropoda
Sub-phylum – Chelicerata
Class – Merostomata
order – xiphosura
Genus – Limulus

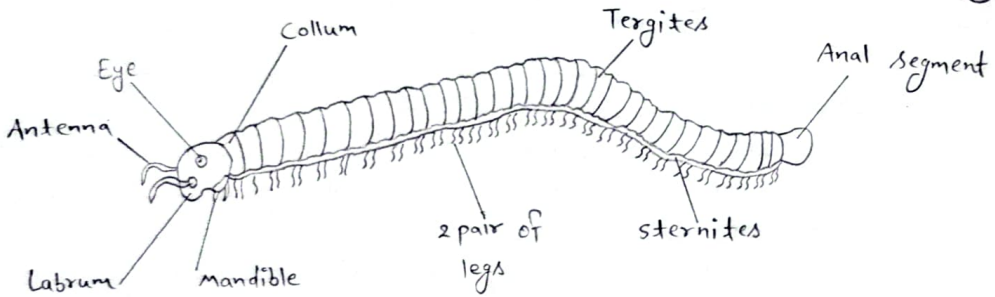
Habit and Habitat:- It lives in shallow water along the Atlantic coast.

Characters:-

1. Body is differentiated into a broad horse shoe-shaped prosoma and a small nearly triangular opisthosoma.
2. Body regions are cephalothorax, abdomen and a long spike like telson or tail.
3. Prosoma is convex along with sloping sides. It contains one median and two lateral longitudinal ridges.
4. Carapace also bears one pair of median and two large composite sub-dorsal or lateral eye.
5. Chelicerae are 3, jointed, small and chelate.
6. Opisthosoma comprise of six segments the mesosoma, a vestigial metasoma and a long spine like telson. Mesosoma contains 6 pairs of imtreable spines.

Teacher's Sign .....

Phylum - Arthropoda
Class - Diplopoda
Order - Julida
Genus - Julus



Julus

Julus (Millipede)

Date __/__/____
Page _____

* Classification:-
Phylum - Arthropoda
Class - Diplopoda (2 pair of legs)
Order - Julida
Genus - Julus

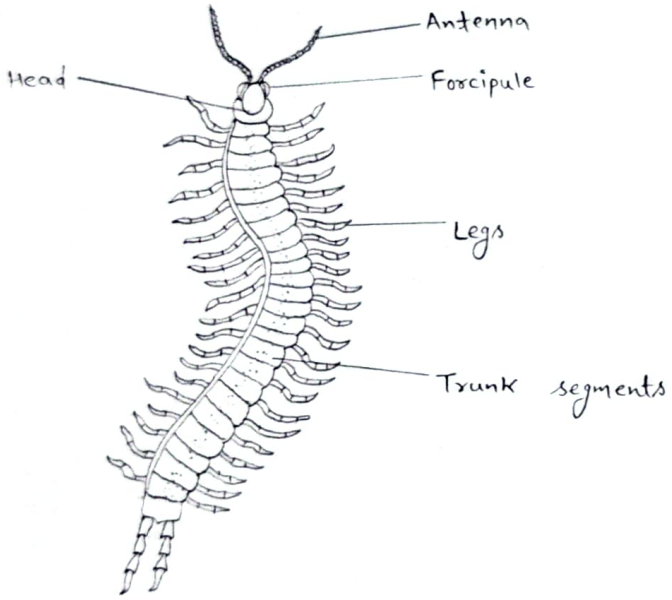
Habit and Habitat:- Millipedes occur on all continents except Antarctica, and occupy almost all terrestrial habitats.

Characters:-

1. They are generally black or brown in colour, although there are a few brightly coloured species and some have aposematic colouring to warn that they are toxic.
2. The exoskeleton is soft and uncalcified, and is covered in prominent setae or bristles.
3. The head of a millipede is typically rounded above and flattened below and bears a pair of large mandibles.
4. The head contains a single pair of antennae with 7 or 8 segments and a group of sensory cones at the tip.
5. Millipede bodies may be flattened or cylindrical, and are composed of numerous metameric segments, each with an exoskeleton consisting of 4 chitinous plates.

Teacher's Sign _____

Phylum- Arthropoda
Subphylum- Myriapoda
Class - Chilopoda
Genus- Scolopendra



Scolopendra

Scolopendra (Centipede)

Date __/__/____
Page _____

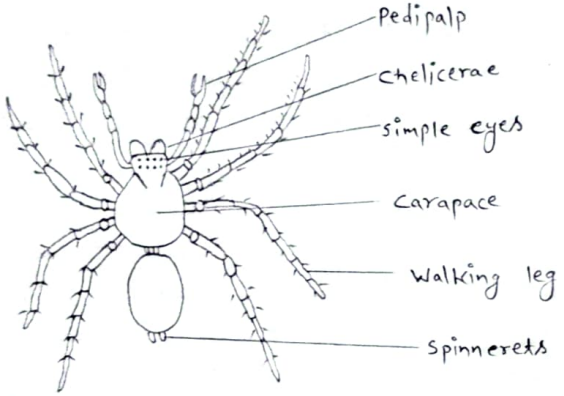
* Classification:-
Phylum- Arthropoda
Subphylum- Myriapoda
Class - Chilopoda
Genus - Scolopendra

* Habit and Habitat:- Centipedes are predominantly generalist carnivores. They have a wide geographical range, which can be found in terrestrial habitats.

* Characters:-
1. Centipedes have a rounded or flattened head, bearing a pair of antennae at the forward margin.
2. They have a pair of elongated mandibles, and two pairs of maxillae.
3. The first pair of maxillae form the lower lip, and bear short palps.
4. The first pair of limbs stretch forward from the body over the mouth.
5. These limbs or forcipules, end in sharp claws and include venom glands that help the animal to kill or paralyze its prey.
6. Their size ranges from a few millimetres in the smaller lithobiomorphs and geophilomorphs to about 30 cm in the largest scolopendromorphs.

Teacher's Sign _____

Phylum - Arthropoda
class - Arachnida
Order - Araneae
Genus - Aranea



Aranea

Aranea (Spider)

Date __/__/____
Page _____

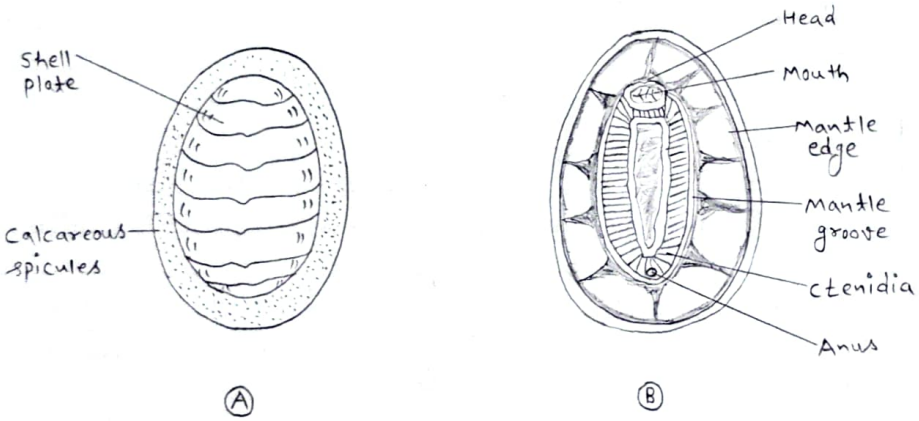
* Classification:-
Phylum - Arthropoda
class - Arachnida (4 pair of legs)
Order - Araneae
Genus - Aranea

* Habit and Habitat:- Juveniles of some spiders in the families Anyphaenidae, Corinnidae, Clubionidae, Thomisidae and Salticidae feed on plant nectar.

* Characters:-
1. Spiders are air-breathing arthropods that have eight limbs, chelicerae with fangs generally able to inject venom.
2. Anatomically spiders differ from other arthropods in that the usual body segments are fused into two tagmata, the cephalothorax or prosoma, and the opisthosoma, or abdomen, and jointed by a small cylindrical pedicel.
3. Spiders do not have antennae.
4. Spiders have the most centralized nervous system of all arthropods, as all their ganglia are fused into one mass in the cephalothorax.
5. Their abdomens bear appendages, modified into spinnerets that extrude silk from up to six types of glands.

Teacher's Sign .....

Phylum - Mollusca
Class - Amphineura
Order - Polyplacophora
Genus - Chiton



Chiton (A) dorsal surface (B) ventral surface

Chiton (Sea myca)

Date __/__/____
Page _____

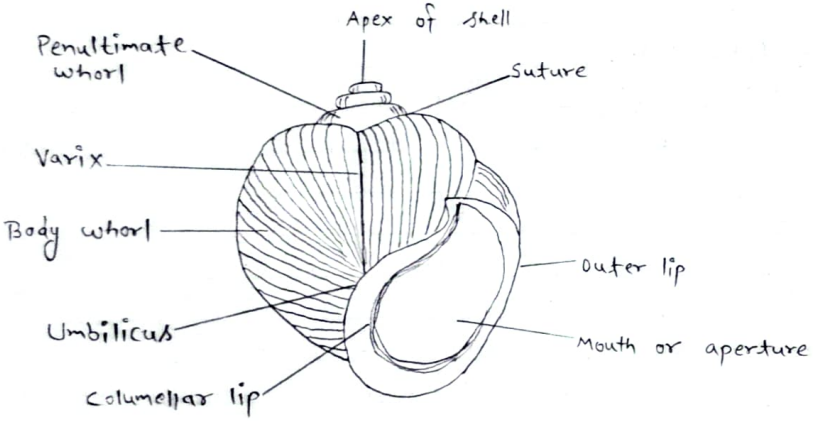
* Classification:-
Phylum - Mollusca (Body soft, unsegmented, triploblastic and bilaterally symmetrical.)
Class - Amphineura (Reduced head lacks eyes and tentacles)
Order - Polyplacophora (Mantle secrets shell with many plates, foot is flattened.)
Genus - Chiton.

* Habitat:- Marine
* Habit:- Sluggish animal found attached to rocks, empty shells and corals, nocturnal, herbivorous.

* Characters:-
1. It is commonly called "Sea myca" or "coat of mail shell."
2. Body is dorsoventrally compressed.
3. Shell with 8 overlapping plates is present dorsally.
4. Foot is ventral and flat helps in creeping.
5. Mantle covers visceral mass.
6. Head is not distinct and lacks eyes and tentacles.
7. Mouth and anus at the opposite ends.
8. Numerous pairs of bipectinate ctenidia lie on either side of the body in mantle groove.
9. Sexes are separate. Gonad is single, gonaducts are paired.
10. Development indirect through trochophore larva.

Teacher's Sign _____

Phylum - Mollusca
Class - Gastropoda
Order - Mesogastropoda
Genus - Pila



Pila globosa

Pila globosa

Date __/__/____
Page _____

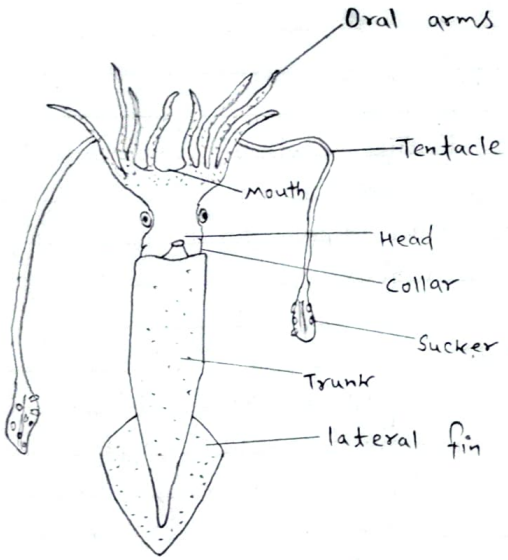
* Classification:-
Phylum - Mollusca (Body soft, unsegmented, triploblastic and bilaterally symmetrical.)
Class - Gastropoda (foot over the belly. Body shows coiling called torsion.)
Order - Mesogastropoda (Monopectinate ctenidium present)
Genus - Pila
Species - globosa

* Habitat:- Fresh water form found in pools, ponds and marshes.
* Habit:- Feeds upon plant scrapping. It is adapted for amphibious life.

* characters:-
1. Shape is globose with lemon yellow, brownish in colour commonly called 'apple snail'.
2. Shell is twisted spirally forming body whorl, penultimate whorl and apex. The shell shows dextral or right handed coiling.
3. Surface of the shell shows lines of growth or varices.
4. When the snail is inside the shell, it is covered with operculum. Operculum too has concentric lines of growth.
5. In buccal mass- radula is present.
6. Respiration by pulmonary sac and ctenidium.

Teacher's Sign _____

Phylum - Mollusca
Class - Cephalopoda
Order - Decapoda
Genus - Loligo



Loligo

Loligo (Squid)

Date __/__/____
Page _____

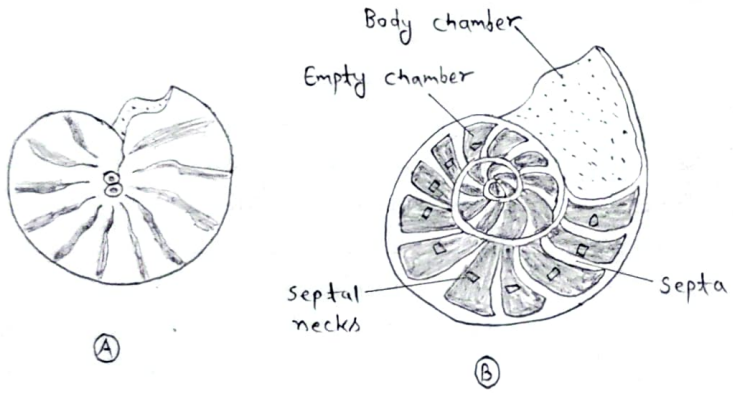
* Classification:-
Phylum - Mollusca (Soft bodied, unsegmented, triploblastic and bilaterally symmetrical)
Class - Cephalopoda (Head distinct surrounded by tentacular foot)
Order - Decapoda (10 legs)
Genus - Loligo

* Habitat:- Marine, found in warmer seas.
* Habit:- Solitary, it is a fast swimmer in open water of sea.

* Characters:-
1. Commonly called 'squid' or 'Sea arrow'.
2. Body is flattened dorsoventrally.
3. Body division:-
(i) Head:- Surrounded by ten oral arms provided with suckers. Two of these arms are long called tentacles and bear suckers at the destal end.
(ii) Trunk or visceral hump.
(iii) Posterior end is equipped with arrow shaped lateral fins or parapodium.
4. Shell is internal penlike which maintains buoyancy.
5. The animal contains 2 ctenidia, 2 kidneys and 2 auricles and ink gland. Blood vascular system is closed type.
6. Development is direct.

Teacher's Sign .....

Phylum - Mollusca
class - Cephalopoda
Subclass - Tetrabranchia
Genus - Nautilus



Nautilus - (A) Shell (B) Section of the shell

Nautilus

Date __/__/____
Page _____

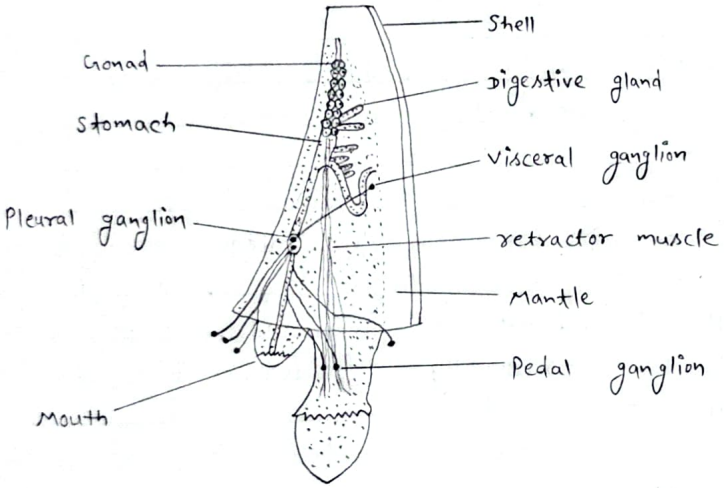
* Classification:-
Phylum - Mollusca (Body soft, unsegmented, triploblastic, bilaterally symmetrical.)
Class - Cephalopoda (Head distinct, surrounded by tentacular foot.)
Sub-class - Tetrabranchia (4 gills are present, shell is external)
Genus - Nautilus

* Habitat:- Marine, found in deep water.
* Habit:- Nocturnal, carnivorous.

* Characters:-
1. The animal is commonly called "pearly nautilus" because the inner layer of shell is pearly
2. Shell is external and is coiled spirally
3. Shell is internally divided into chambers by means of septa.
4. The septa are perforated in the middle. Through the performation passes a chord called "siphuncle" which is the extension of visceral mass.
5. Body division:-
(i) Head:- with mouth and a pair of eyes surrounded by about 90 filliform tentacles without suckers.
(ii) Trunk is bag like with 4 gills, 4 kidneys, and 4 auricles. Osphradia are present.

Teacher's Sign .....

Phylum - Mollusca
Class - Scaphopoda
Genus - Dentalium



Dentalium

Dentalium

Date __/__/____
Page _____

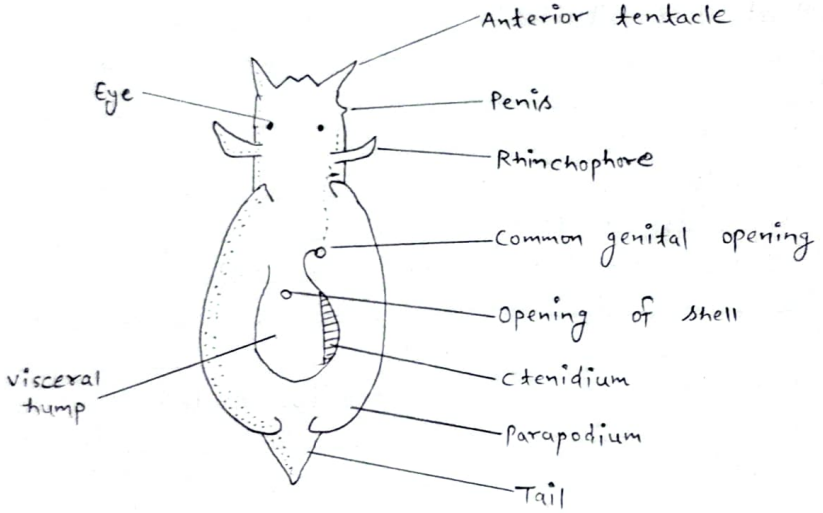
* Classification:-
Phylum - Mollusca (Body soft, unsegmented, triploblastic, bilaterally symmetrical.)
Class - Scaphopoda (Tubuler shell)
Genus - Dentalium

* Habit and Habitat:- Dentalium is marine and found in the sand at the depth.

* Characters:-
1. Commonly known as 'elephant's tusk-shell'.
2. Body is bilaterally symmetrical and enclosed in a tubular shell open at both end.
3. Body consist of head, foot, mantle and visceral mass.
4. Foot is long and conical, protrudes through the anterior opening of the shell and is used in burrowing.
5. Anus lies behind the base of the foot.
6. Radula is well developed.
7. Gills are absent.
8. Vascular system is poorly developed without distinct head.
9. A pair of nephridia is present.
10. Eyes absent and oocytes present.

Teacher's Sign _____

Phylum- Mollusca
Class- Gastropoda
Subclass- ophisthobranchia
Genus- Aplysia



Aplysia

Aplysia

Date __/__/____
Page _____

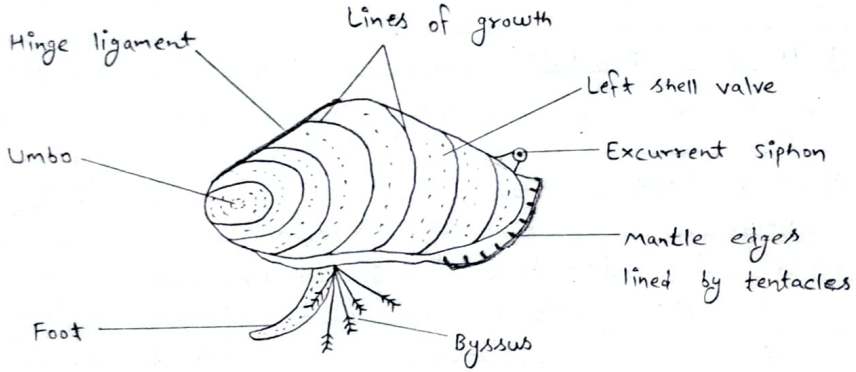
* Classification:-
Phylum- Mollusca (Body soft, unsegmented, triploblastic and bilaterally symmetrical)
Class- Gastropoda (Foot over the belly. Body shows coiling called torsion)
Subclass ~~Order~~- Ophisthobranchia
Genus- Aplysia

* Habit & Habitat:- Marine gastropod mollusc, generally found near sea weed.

* characters:-
1. Aplysia is commonly known as 'sea-hare'.
2. It is tectibranch gastropod, found crawling over the surface of rocks and boulders.
3. The body is without an external shell and is large-sized.
4. The small internal shell is covered externally by the mantle.
5. The head bears two pairs of tentacles which are grooved on their outer sides; the posterior pair becomes ear-like and is called the rhinophores.
6. At the base of each of these tentacles is located a simple eye.
7. The foot is broad and bears a pair of lateral folds, the parapodia, used in swimming.

Teacher's Sign _____

Phylum- Mollusca
class - Pelecypoda
Order- Mytilida
Genus- Mytilus



Mytilus

Mytilus

Date __/__/____
Page _____

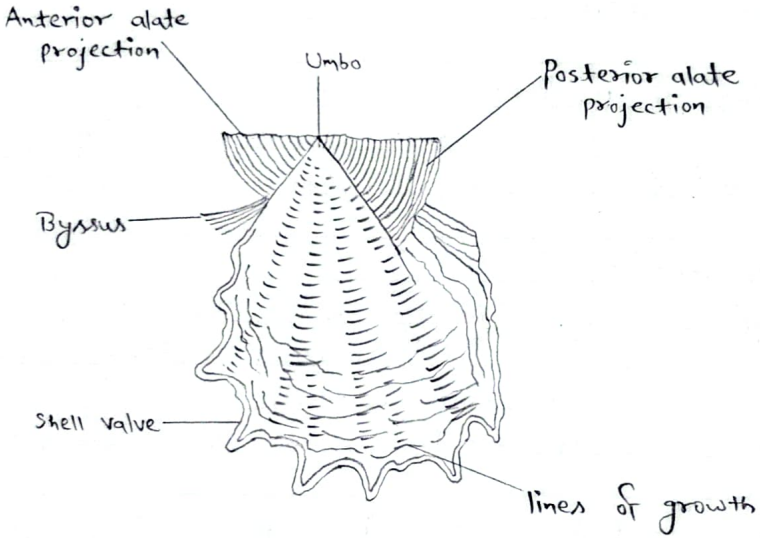
* Classification:-
Phylum- Mollusca (Body soft, unsegmented, triploblastic, bilaterally symmetrical)
Class - Pelecypoda (Bivalved shells)
Order - Mytilida
Genus- Mytilus

* Habit & Habitat:- It is a cosmopolitan, marine and sedentary animal, found attached to rocks between tide-marks.

* characters:-
1. Mytilus is commonly known as 'Sea-mussel'.
2. It is a filter feeder, filtering planktons from the incurrent water.
3. The shell is bivalve with the anteriorly placed umbo.
4. The ventral foot is tongue-like with byssus threads, serving as organs for attachment. A pair of simple eyes is found anterior to the inner gill lamella.
5. The sexes are separate.

Teacher's Sign .....

Phylum - Mollusca
class - Pelecypoda
Order - Pteriida
Genus - Pinctada



Pinctada vulgaris

Pinctada vulgaris (Pearl oyster)

Date __/__/____
Page _____

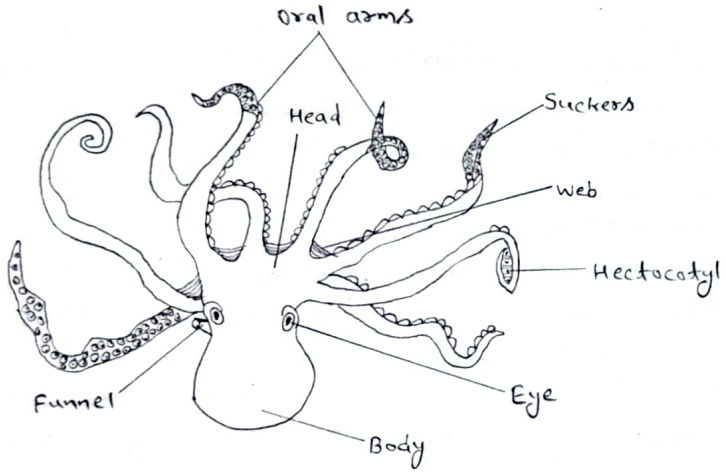
* Classification:-
Phylum - Mollusca (Body soft, unsegmented, triploblastic, bilaterally symmetrical)
Class - Pelecypoda (Bivalved shells)
Order - Pteriida
Genus - Pinctada

* Habit and Habitat:- Oysters are sedentary marine molluscs found in all seas except in colder ones.

* Characters:-
1. It is commonly known as 'pearl oyster'
2. The Indian pearl oyster is Pinctada vulgaris that is known for yielding precious pearls.
3. The two shells are unequal, with the left one comparatively larger than the right one and remains attached to a rock.
4. The adductor muscle is single and large.
5. The foot is lacking in the adult.
6. Pearl is formed as a result of nacreous secretion from the mantle around a sand particle.

Teacher's Sign .....

Phylum - Mollusca
Class - Cephalopoda
Order - Octopoda
Genus - Octopus



Octopus

Octopus

Date __/__/____
Page _____

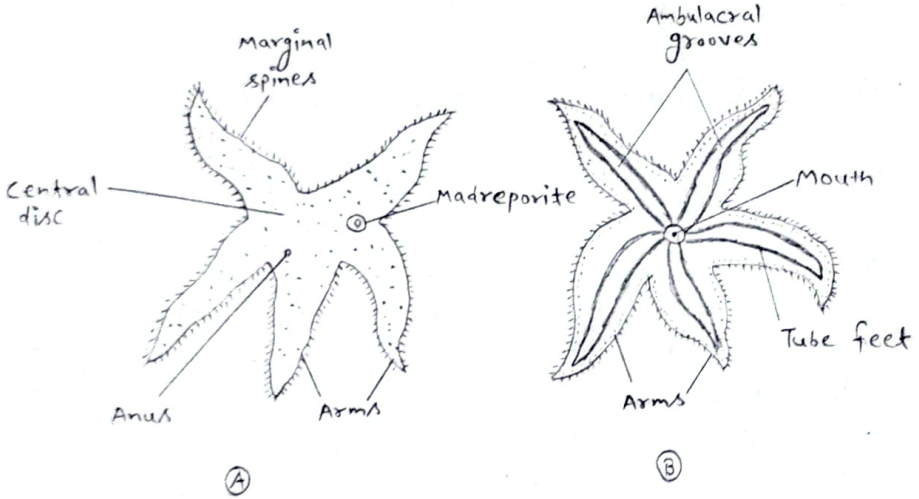
* Classification:-
Phylum - Mollusca (Body soft, unsegmented, triploblastic, bilaterally symmetrical.)
Class - Cephalopoda (Head distinct, surrounded by tentacular foot.)
Order - Octopoda (8 legs)
Genus - Octopus

* Habit and Habitat:- Octopuses inhabit various regions of the ocean, including coral reefs, pelagic waters, and the seabed.

* Characters:-
1. It is also known as 'devil-fish'.
2. It is an octopod cephalopod, possessing eight oral arms.
3. Body is globular and bag-like and there are no lateral fins and internal shell as are seen in Sepia or Loligo.
4. The head bears a mouth and two large prominent eyes.
5. The oral arms are much elongated and bear suckers in two rows on their inner surfaces.
6. These arms are jointed together at their bases by a web.
7. It is a benthic hunter.

Teacher's Sign .....

Phylum- Echinodermata
Class - Asteroidea
Order - Forcipulata
Genus - Asterias



Asterias (A) Aboral surface (B) Oral surface

Asterias (Star fish)

Date __/__/____
Page _____

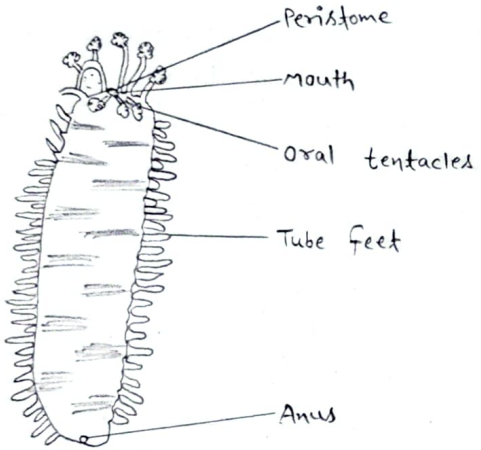
* Classification:-
Phylum - Echinodermata (Spines are present on skin, secondary pentamerous symmetry present)
Class - Asteroidea (Central disc and arms are not distinct)
Order - Forcipulata (Forcep like pedicellariale present)
Genus - Asterias

* Habitat:- It is marine, found below 200 fathoms.
* Habit:- Animal is benthamic form, carnivorous.

* Characters:-
1. Body is star shaped hence the animal is commonly called 'star fish'.
2. Body shows pentamerous radial symmetry.
3. From the pentagonal central disc radiate out five arms.
4. Oral surface has mouth in the centre from which extend out five ambulacral grooves.
5. Aboral surface contains ambulacral actinal areas alternated by adambulacral or abactinal areas.
6. A small opening called anus is present near the centre of aboral surface.
7. Mouth and anus at the opposite surface.
8. Water vascular system is present.
9. Sexes are separate, fertilization external.
10. Development - indirect through bipinnaria and branchiolaria larva.

Teacher's Sign _____

Phylum - Echinodermata
Class - Holothuroida
Order - Aspidochirota
Genus - Holothuria



Holothuria

Holothuria

Date __/__/____
Page _____

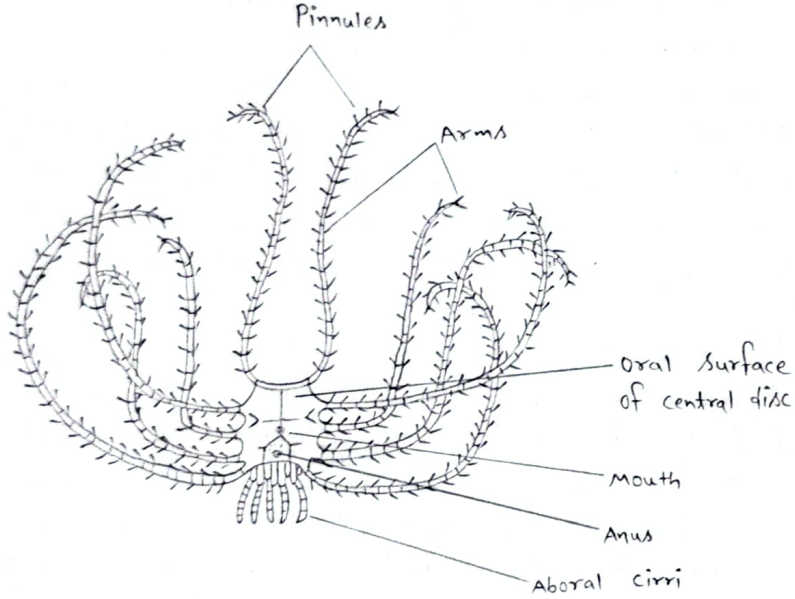
* Classification:-
Phylum - Echinodermata (Spines are present on skin, triploblastic, enterocoelomate)
Subphylum - Eleutherozoa (Without stalk and free living)
Class - Holothuroida (Body cylindrical, elongated on oral-aboral axis)
Order - Aspidochirota (tentacles leaf like)
Genus - Holothuria

* Habitat:- Marine, found near sea coasts.
* Habit:- Moves slowly on the sea bottom by the contraction of the body wall and assisted by tubefeet. They feed upon micro-organisms.

* Characters:-
1. The animal is commonly called 'sea cucumber'.
2. Body is cylindrical, elongated at the oral-aboral axis.
3. Oral end contains a mouth encircled by leaf like tentacles which help in collecting food.
4. Water vascular system has many polian vesicles and internal madreporite. Tubefeet are provided with suckers.
5. Pedicellariae and spines are absent.
6. Ambulacral grooves are internal.
7. Respirating tubes and tubules of cuverian open in cloaca.

Teacher's Sign .....

Phylum - Echinodermata
class - Crinoidea
Order - Articulata
Genus - Antedon



Antedon

Antedon

Date __/__/____
Page _____

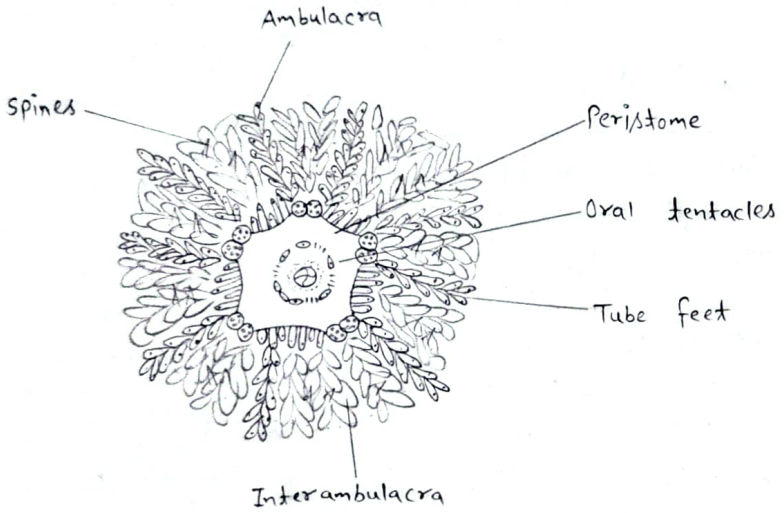
* Classification:-
Phylum - Echinodermata (Coelomate, pentaradiate and spiny skinned animals)
Subphylum - Pelmatozoa (Sedentary throughout life)
Class - Crinoidea (Attachment by aboral stalk)
Order - Articulata (central disc covered by a movable tegmen having various ossicles)
Genus - Antedon

* Habit and habitat:- It is marine and occurs about 2 fathoms deep and remains attached to rocks by cirri from central disc.

* Characters:-
1. Commonly called as sea-lily or feather-star.
2. On the aboral side calyx bears a knob-like structure called as centrodorsal plate or stalk.
3. The calyx is differentiated into an upper convex oral surface, having mouth and anus and the lower flat aboral surface, into which arms and cirri are inserted.
4. On the aboral side calyx bears a knob-like structure, called as stump of the stalk.
5. There are 10 arms having extensions of viscera and each bears numerous pinnules containing gonads.
6. Sea-lily attaches to substratum by cirri. Anus on aboral surface.

Teacher's Sign _____

Phylum - Echinodermata
Class - Echinoidea
Order - Camarodonta
Genus - Echinus



Echinus

Echinus

Date __/__/____
Page _____

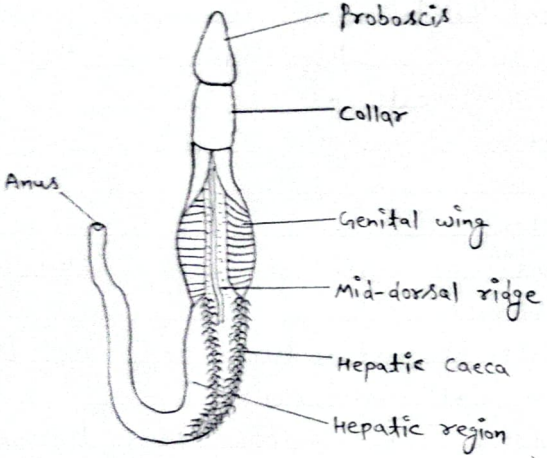
* Classification:-
Phylum- Echinodermata (Coelomate, pentaradiate and spiny skinned animals)
Class- Echinoidea
Order- Camarodonta
Genus- Echinus

* Habit and habitat:- It is marine and benthonic animal. They habitually live in hard or rocky bottoms. They eat all sorts of food available at the bottom of sea.

* characters:-
1. It has a spherical body with a flattened oral surface.
2. The internal structures of the body are housed in a shell or corona.
3. The mouth is placed at the centre of the peristome and the anus is eccentrically placed in the periproct.
4. Five pairs of small gills project from the peristomial membrane that encircles the mouth.
5. The body wall consists of an epidermis on the outer side, a middle layer of dermis and an inner lining of coelomic epithelium.
6. The respiratory system of Echinus consists of five pairs of small, branched and thin-walled outgrowths of body.

Teacher's Sign .....

Phylum - Hemichordata
Class - Enteropneusta
Genus - Balanoglossus



Balanoglossus

Balanoglossus

Date __/__/____
Page _____

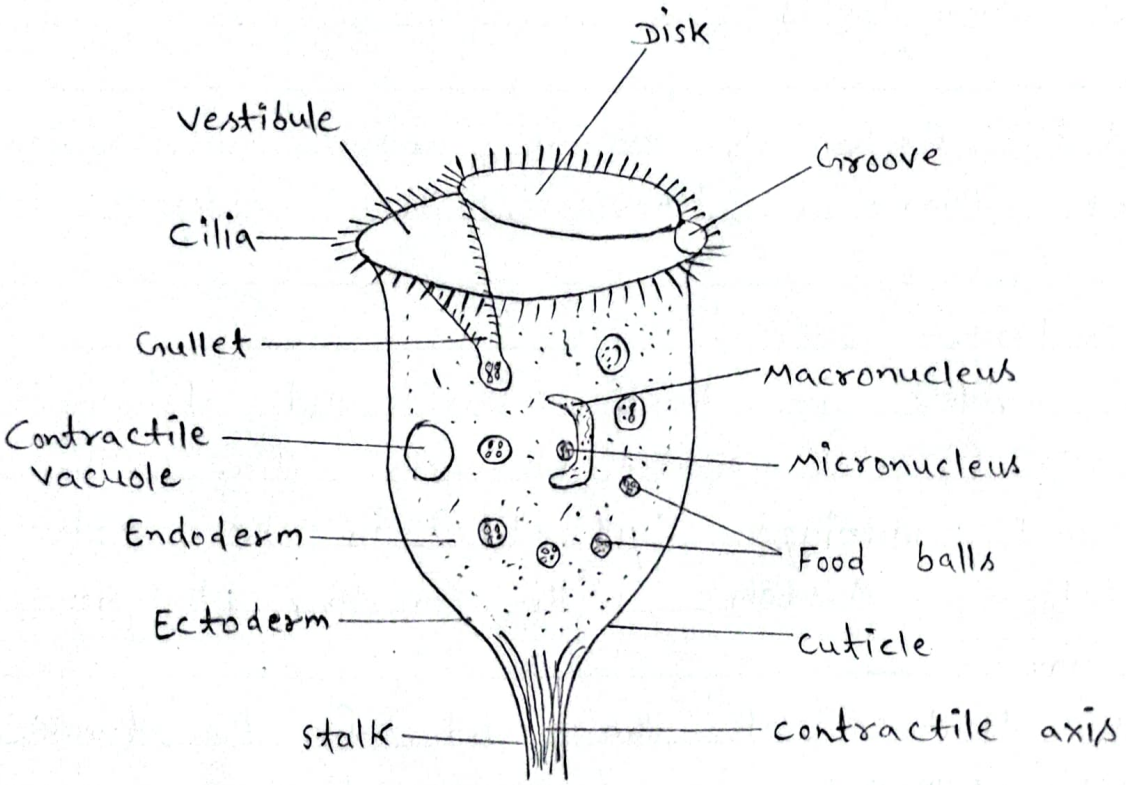
* Classification:-
Phylum - Hemichordata (Buccal diverticulum, enteroccelomate, bilateral symmetry)
Class - Enteropneusta
Genus - Balanoglossus

* Habitat:- Exclusively marine, often in sand or mud
* Habit:- Burrowing behaviour, Filter feeder or detritivore.

* Characters:-
1. Body divided in head, collar and trunk regions.
2. Proboscis (frontal projection) with cilia.
3. Branchial openings (gill slits) in the collar region.
4. Digestive system with mouth, pharynx and intestine.
5. Anus located at the end of the trunk.
6. Dorsal hollow nerve cord.
7. Collar like structure around the pharynx.
8. Respiratory system involves diffusion through the body surface.
9. Reproduction sexual.
10. Larval stage (tornaria) with ciliary bands.
11. Metamorphosis into the adult form.

Teacher's Sign .....

Phylum - Protozoa
class - Ciliata
order - Peritricha
Genus - Vorticella



Vorticella

Vorticella

Date __/__/____
Page _____

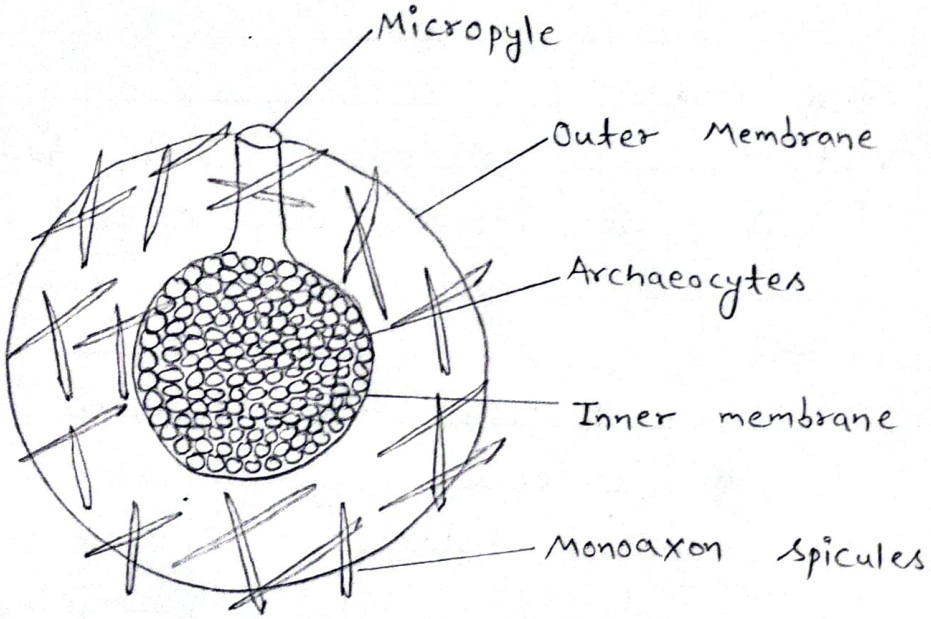
Classification:-

Phylum - Protozoa (Unicellular)
Class - Ciliata (Cilia persist throughout life)
Order - Peritricha (Body bell shaped attached with a long stalk)
Genus - Vorticella

Characteres:-

1. Vorticella is solitary animal found in rivers, ponds. It is also found attached to weeds, stones, aquatic worms, fishes and amphibians with the help of its stalk.
2. Due to the bell shaped body it is often called bell animalcule.
3. The body consists of a thin pellicle and cytoplasm is differentiated into ectoplasm and endoplasm.
4. A vestibule or infundibulum is found between the peristome and the peristomal disc.
5. Mouth is situated at the bottom of vestibule leading into the cytopharynx ending into protoplasm.
6. A ciliary disc is present in the peristome which consists of an outer adoral cilia and an inner adoral cilia.
7. Endoplasm contains food particles, long and curved macronucleus and small micronucleus and cytopyge.
8. Nutrition is holozoic.

Teacher's Sign .....



Sponge gemmule

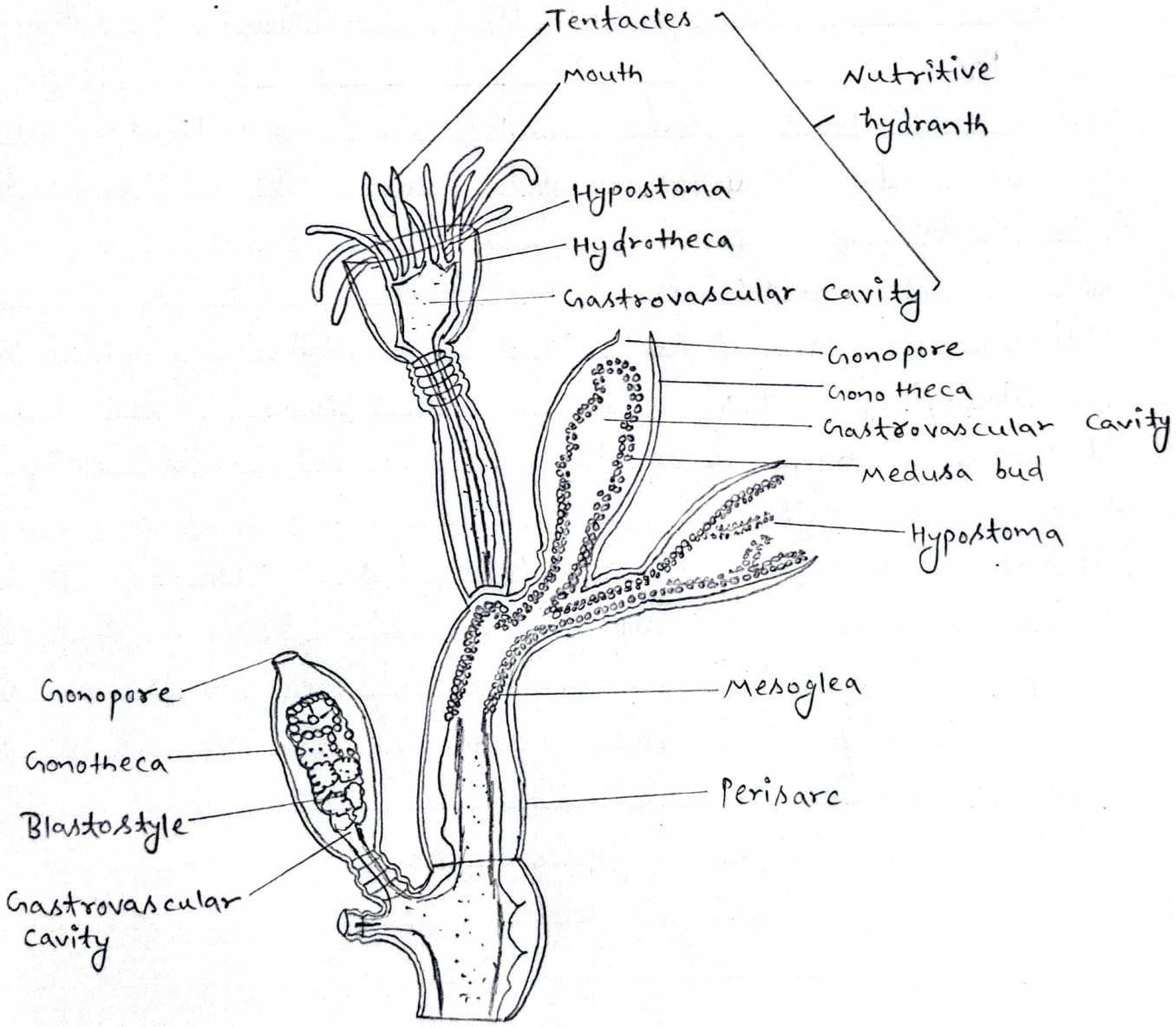
Sponge Gemmules

Date __/__/____
Page _____

1. In fresh water and a few marine sponge Gemmules are asexual reproductive bodies.
2. Gemmules are formed in hot and cold to resist with the unfavourable condition like draught or cold.
3. These are small hard ball like structures consisting of an outer capsule and an internal mass of archaeocytes.
4. Capsule is made of an inner and an outer chitinous layers. Outer layer contains amphidiscs to strengthen the capsule in some forms.
5. At one end, Gemmule opens to the exterior through micropyle.
6. Internal mass of archaeocytes is filled with reserve food material formed by trophocytes.
7. During favourable conditions the mass of cells pass out by micropyle and develops into a young Sponge.

Teacher's Sign .....

Phylum - Coelenterata
Class - Hydrozoa
Order - Hydroida
Genus - Obelia



Obelia Colony

Obelia

Date __/__/____
Page _____

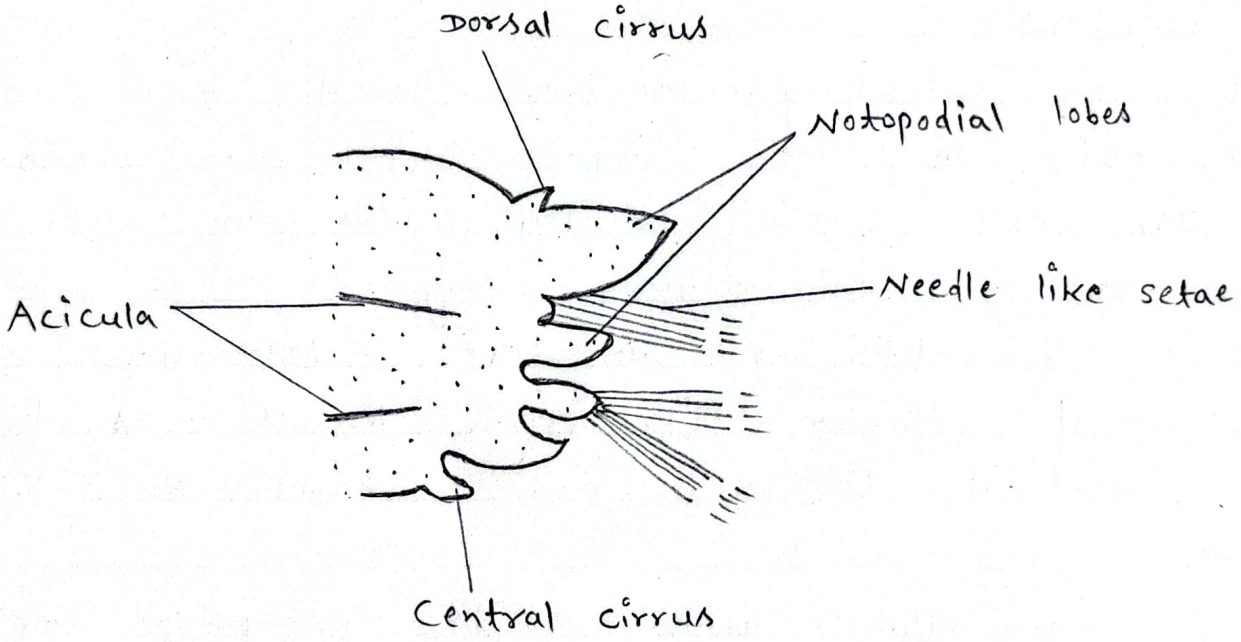
* Classification:-

Phylum - Coelenterata (Diploblastic, tissue grade organization)
Class - Hydrozoa (Hydroids bearing medusa with true velum)
Order - Hydroida (Polypoid)
Genus - Obelia

* Characters:-

1. It is sedentary, marine colonial form found attached on the surface of sea weeds, molluscan shells, rocks and wooden piles in shallow water.
2. It is a trimorphic colony.
3. It is attached to the substratum with a horizontal thread like root knows as hydrorhiza.
4. A vertical branch arises from the hydrorhiza called hydrocaulus.
5. The hydrocaulus bears zooids or polyps on either side. Each polyp consists of a stem and a head called hydranth.
6. The entire colony covered with a tough yellow chitin called perisarc.
7. The obelia is a trimorphic colony consisting of polyps or hydranths (nutritive zooids) Gonangia or blastostyles (budding zooids) and medusae (sexual zooids).

Teacher's Sign .....



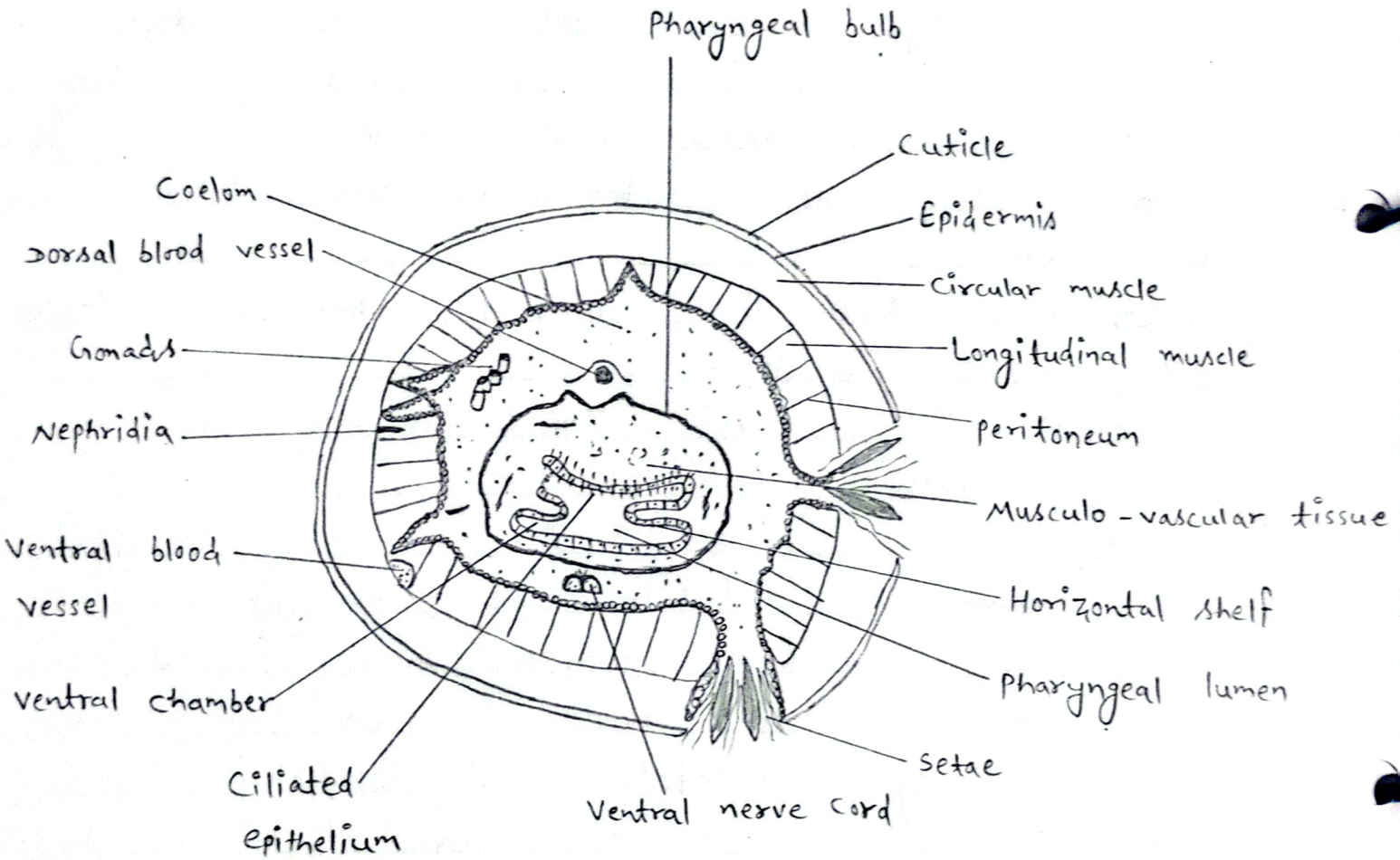
Nereis : Parapodium

Nereis: Parapodium

Date __/__/____
Page _____

1. Parapodium, cut from segment and stained, shows the following structure.
2. Each segment of the body except the peristomium and pygidium bears on lateral side a flat hollow fleshy and ventral flap-like outgrowth, called as parapodium, name given by Huxley.
3. Parapodium is bilobed, and setae-bearing organ composed of upper notopodium and lower neuropodium.
4. Notopodium has two unequal lobes upper larger and lower smaller.
5. Neuropodium has two equal fleshy and much smaller lobes.
6. Dorsal and ventral cirri, attached to notopodial and neuropodial bases are present.
7. Notopodium and neuropodium bear several, spine-like setae, lodged in setigerous sacs. They are supported by skeletal rods, called acicula.
8. First 2 pairs of parapodia lack the notopodial setae.
9. Parapodia are highly muscularised, glandularised and vascularised to function as locomotory and respiratory organs. They are adapted for crawling movement also.

Teacher's Sign .....



Earthworm: T.S. passing through pharynx

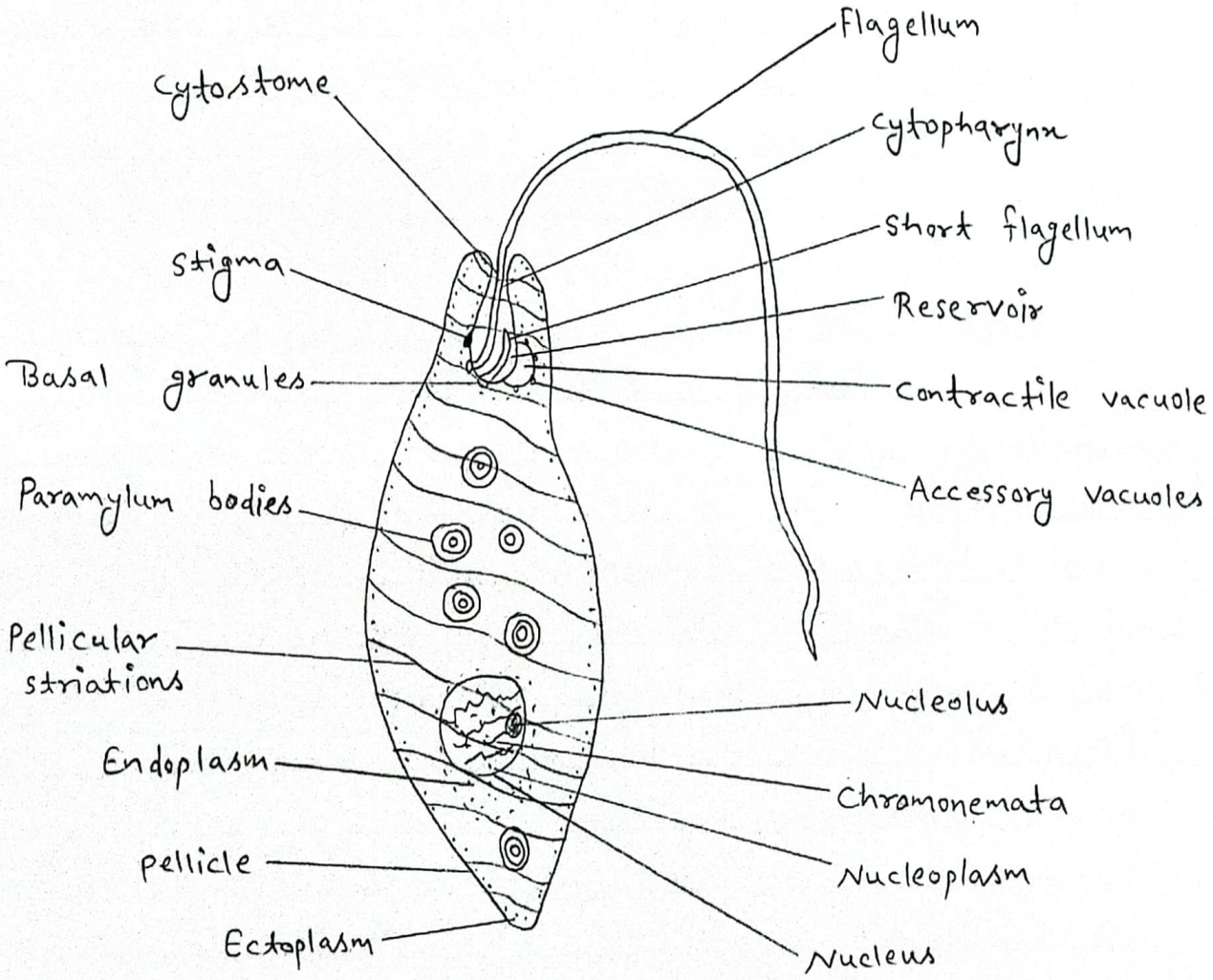
Earthworm: T.S. passing through pharynx

Date __/__/____
Page _____

1. The section shows organ grade of body organization, triploblastic layeration and true coelom. Pharynx is clearly seen.
2. Pharynx is a wide pear-shaped and thick walled muscular chamber.
3. Pharyngeal cavity dorsoventrally compressed.
4. Body wall composed of cuticle, epidermis, musculature and parietal epithelial layer.
5. Cuticle is thin, non-cellular, double layered, iridescent and made up of collagen protein, gelatin and polysaccharide.
6. Epidermis is made up of single layered distinct columnar cells with gland cells, supporting cells, basal cells and receptor cells.
7. Musculature is made up of outer continuous circular muscle fibers and inner longitudinal muscle fibers cut in bundles.
8. The pharynx contains visceral epithelial layer, pharyngeal gland cells, musculo-vascular tissue and pharyngeal lumen.
9. From the pharyngeal wall radial muscle strand run outward up to body wall. The contractions of these radial muscle strands dilate the pharyngeal cavity which works as suction pump.
10. The pharyngeal lumen is divided by an incomplete horizontal shelf into an upper salivary chamber and a lower conducting or ventral chamber.

Teacher's Sign .....

Phylum- Protozoa
class - Mastigophora
Order- Euglenoidina
Genus- Euglena



Euglena

Euglena

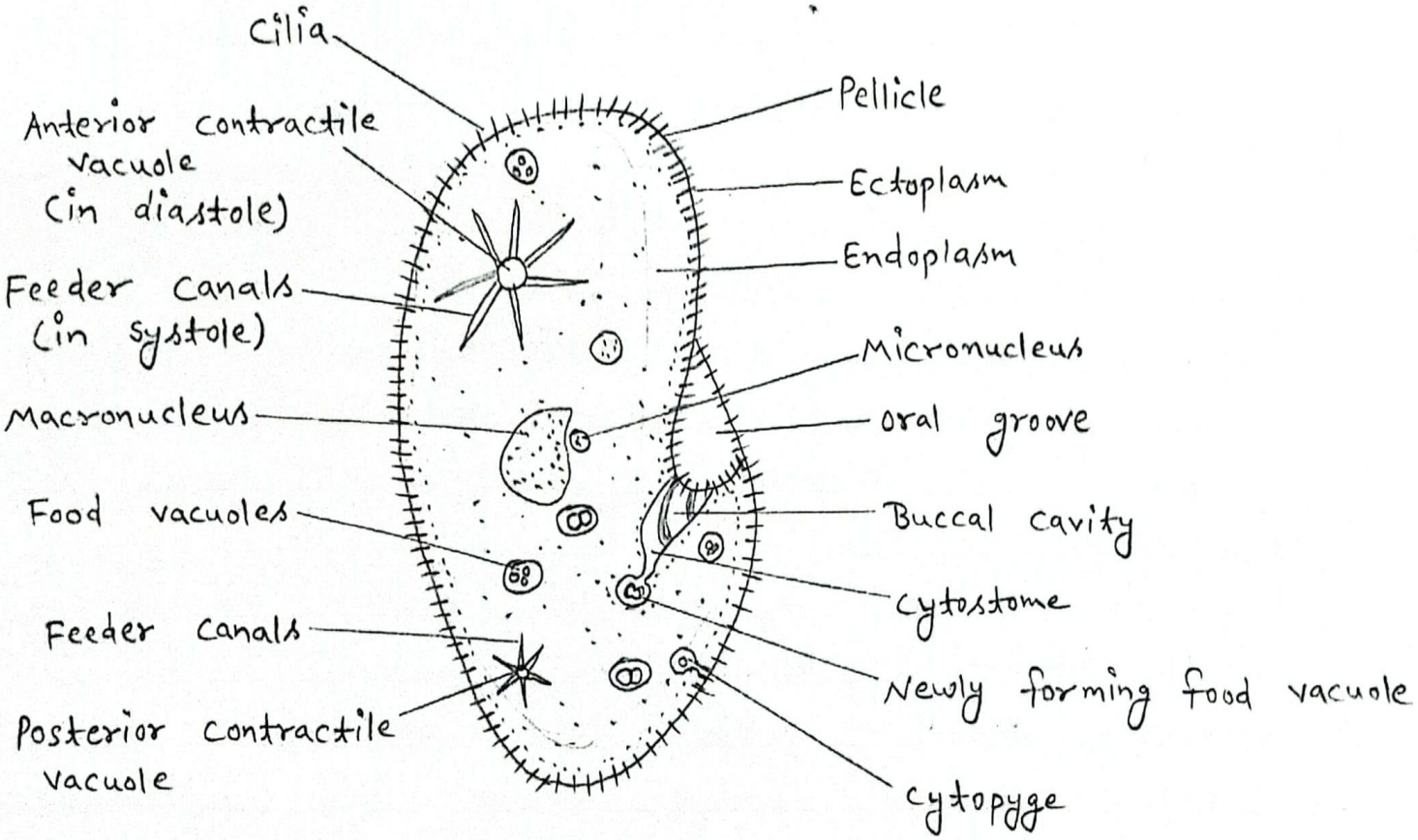
Date __/__/__
Page _____

* classification:-
Phylum - Protozoa (Microscopic and Unicellular)
Class - Mastigophora (One or more flagella)
Order - Euglenoidina (Body covered with pellicle)
Genus - Euglena

* characters:-
1. Euglena is found in fresh water ponds, ditches, lakes and slow running streams.
2. Body of the animal is simple fusiform, spindly shaped measuring from 40-100 microns in length.
3. Cytoplasm is differentiated into ectoplasm and endoplasm.
4. Body is covered by striated pellicle marked by spiral striations known as myonema.
5. Anterior end of the body exhibits a funnel shaped cytosome which leads into cytopharynx.
6. A photosensitive organ stigmata is also present on one side of the body.
7. A conspicuous nucleus is located at the posterior region of the body.
8. Two flagella arising each from a blepheroplast situated beneath the cytopharynx. Both the flagella unite to form a single long flagellum which projects from the cytosome.
9. Contractile vacuola is surrounded by tiny accessory vacuoles.

Teacher's Sign .....

Phylum - Protozoa
Class - Ciliata
Order - Holotricha
Genus - Paramecium



Paramecium

Paramecium

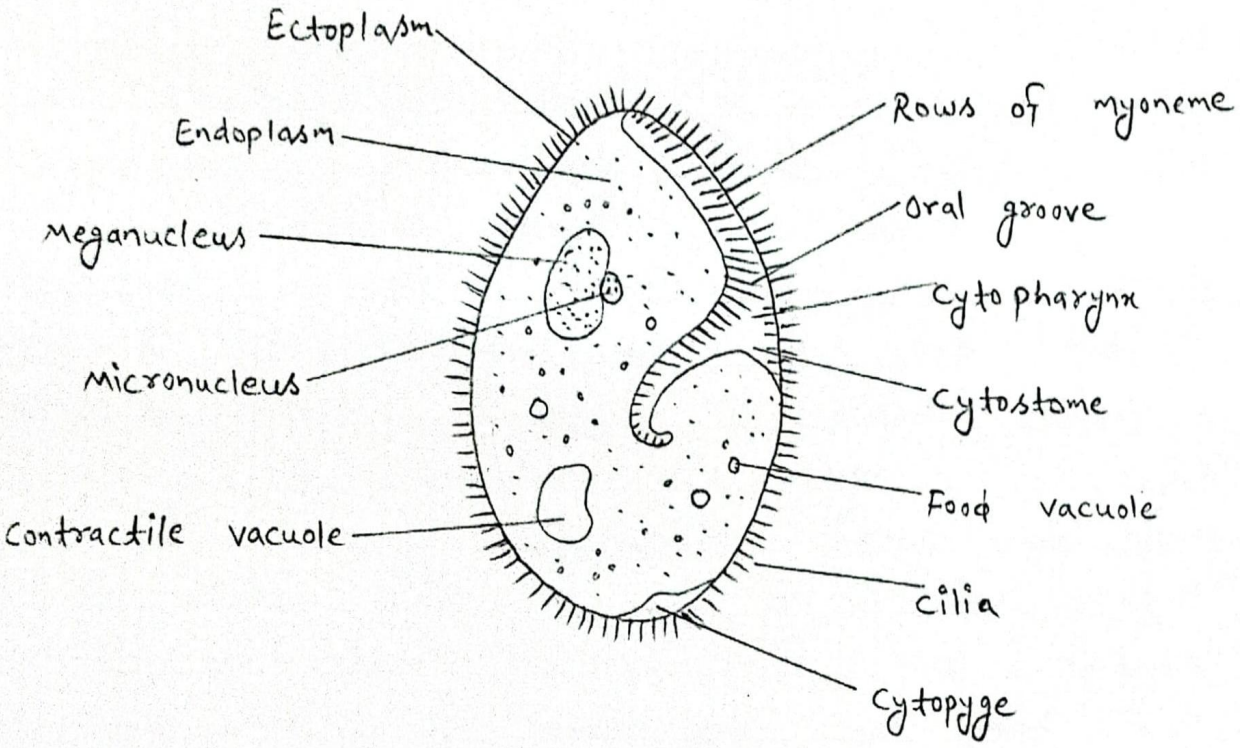
Date __/__/__
Page _____

* Classification:-
Phylum - Protozoa (Unicellular)
Class - Ciliata (Cilia persist throughout life)
Order - Holotricha (Uniformly distributed cilia)
Genus - Paramecium

* Characters:-
1. Commonly found in fresh water ponds, ditches, pools, streams, lakes and rivers.
2. Commonly known as slipper animalcule.
3. Anterior part is slender with a blunt or rounded end, while the posterior end is pointed or cone shaped.
4. Body is covered with numerous small hairs like projections called cilia.
5. Body is covered by a thin, double layered, elastic and firm pellicle made of gelatin.
6. This hair like projections of uniform length except at posterior end where they are longer and at cytopharynx where they form undulating membrane.
7. Cytoplasm is differentiated into ectoplasm and endoplasm. Ectoplasm has myonemes and rod-shaped trichocysts.
8. Endoplasm contains food vacuoles, granules, meganucleus, micronucleus, anterior contractile and posterior contractile vacuole, fat and glycogen.
9. Reproduction by binary fission, endomixis, hemixis, automixis and conjugation.

Teacher's Sign .....

Phylum - Protozoa
class - oligohymenophorea
Order - Hymenostomatida
Genus - Nyctotherus



Nyctotherus

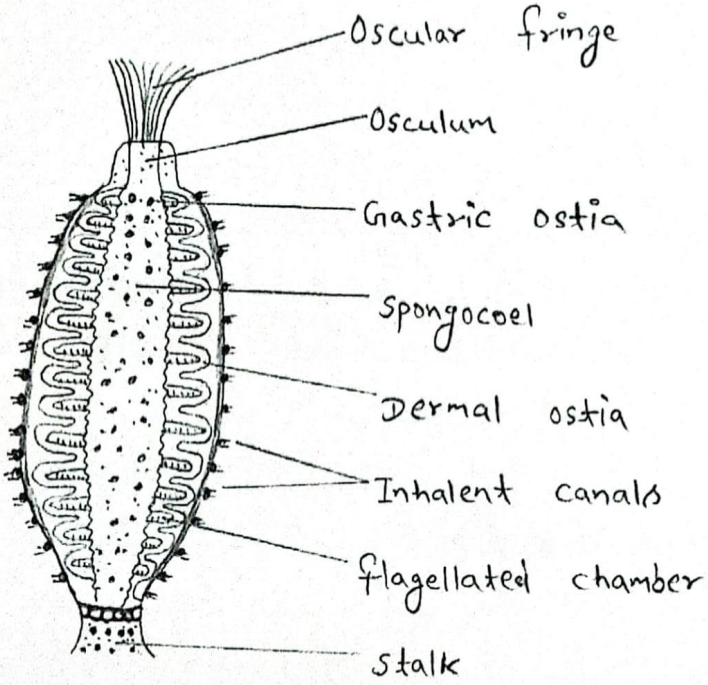
Nyctotherus

Date __/__/____
Page _____

* Classification:-
Phylum - Protozoa
Class - Oligohymenophorea
Order - Hymenostomatida
Genus - Nyctotherus

* Characters:-
1. Endoparasites in the rectum of vertebrates and intestine of some invertebrates.
2. Body somewhat bean-shaped and bears uniform ciliation all over.
3. Cytoplasm well differentiated into ectoplasm and granular endoplasm.
4. The ectoplasm is having oblique rows of myonems.
5. Endoplasm is having a large and somewhat kidney-shaped macronucleus, a small micronucleus attached to it, a large eccentric contractile vacuole and numerous small food vacuoles.
6. On one side it bears a deep oral groove which, near the middle of the animal, communicates through a wide cytostome continuing into a deep and coiled tube - the cytopharynx.
7. Near the posterior end is present a small cytopyge or the anus.
8. The oral groove bears rows of aboral ~~cilia~~ cilia and cytopharynx bears undulating membrane.
9. Nutrition is generally saprozoic.

Teacher's Sign .....

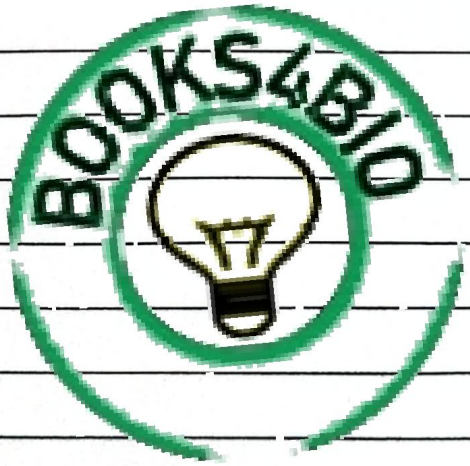

Oscular fringe
Osculum
Gastric ostia
Spongocoel
Dermal ostia
Inhalent canals
flagellated chamber
Stalk

Sycon - L.S.

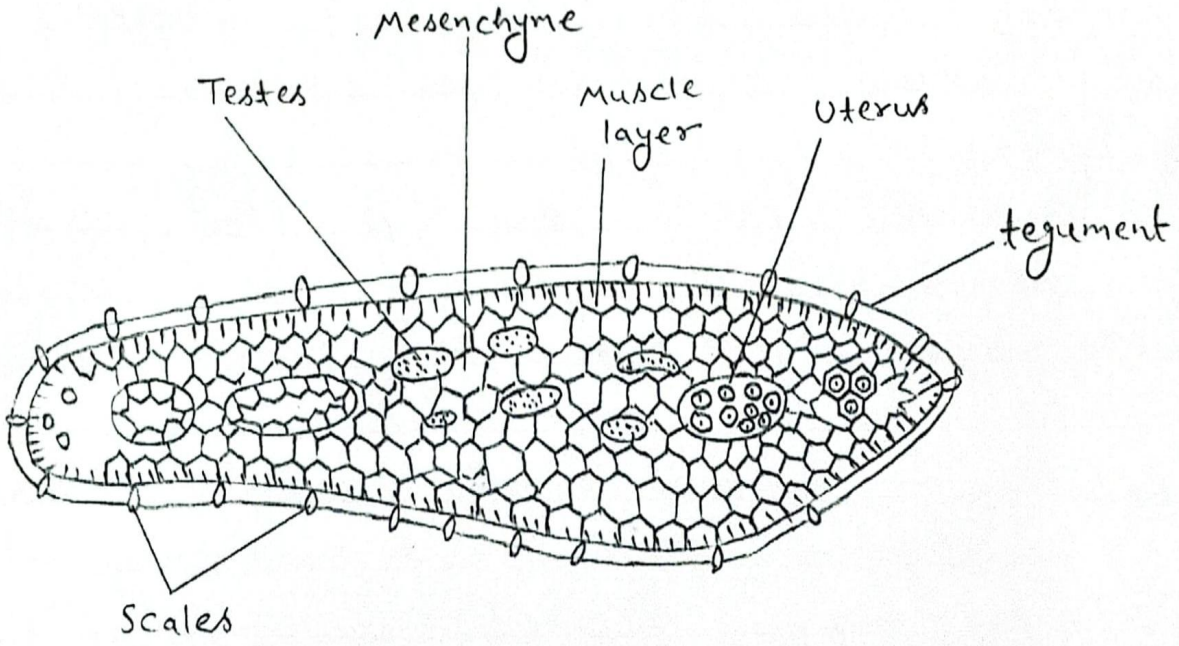
Sycon - L.S.

Date __/__/____
Page _____

1. Body wall consists of ectoderm, mesenchyme and endoderm.
2. Ectoderm bears small pores called dermal ostia.
3. Mesenchyme consists of amoebocytes, gelatinous transparent matrix and spicules.
4. Endoderm consists of collar cells or choanocytes and forms the lining of flagellated chambers.
5. Flagellated chambers open through apopyle in the spongocoel.
6. Incurrent canals and flagellated chambers are communicated by prosopyles.
7. Spongocoel opens to the exterior by osculum.
8. The path of water circulation is Ostia → Incurrent canal → prosopyle → radial canal → apopyles → spongocoel → Osculum → Exterior (out)



Teacher's Sign .....



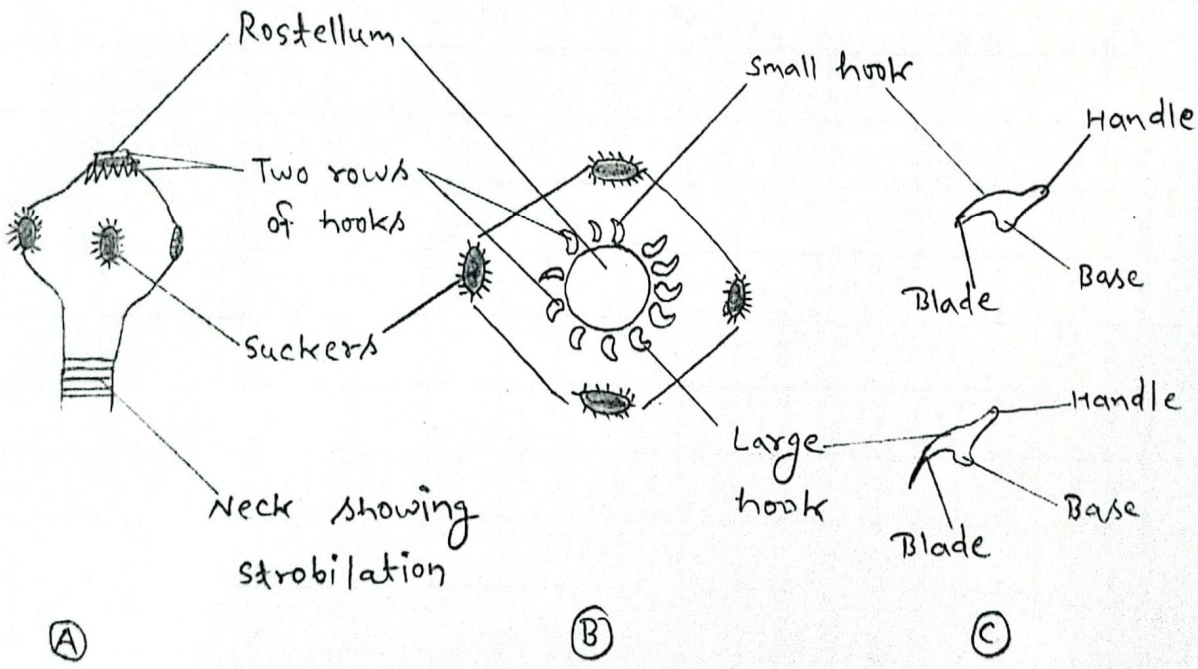
Fasciola hepatica : T.S. passing through testes

Fasciola hepatica : T.S. passing through testes

Date __/__/____
Page _____

1. Body wall is consist of tegument musculature and mesenchyme.
2. Body outermost covering is made up of cuticle.
3. Spines and scales are also found on cuticle.
4. Circular longitudinal and oblique muscles constitute the musculature.
5. Vitelline ducts and glands are visible.
6. Testes containing spermatozoa is clearly visible in the section.

Teacher's Sign .....



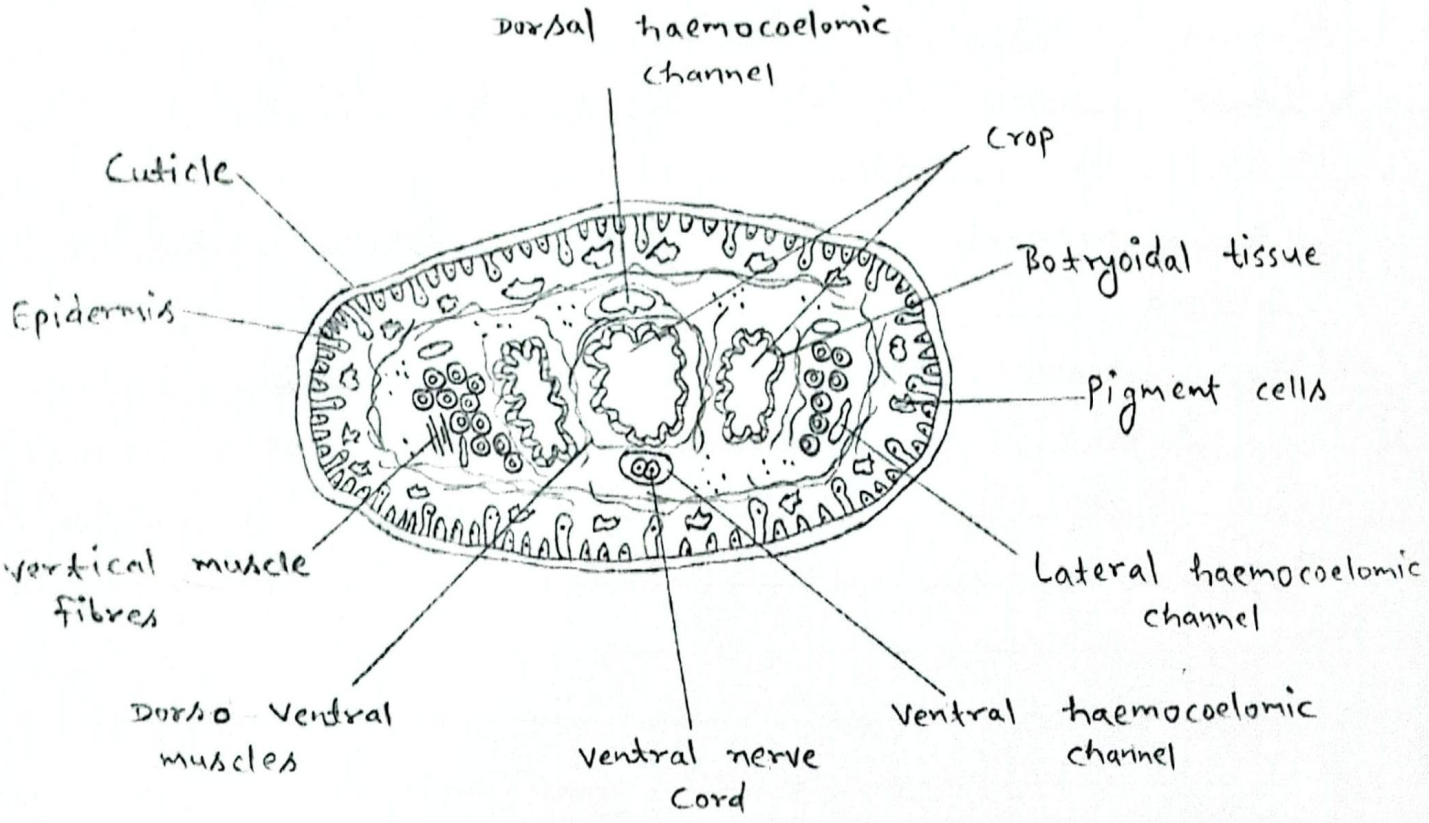
Scolex of Taenia: (A) side view (B) en-face view (c) hooks

Taenia solium : Scolex

Date __/__/__
Page _____

1. Scolex is the anterior knob like structure of the body.
2. It is exhibited by four cup like muscular suckers having radial muscles and an anterior prominent rostellum.
3. Rostellum includes two rows of 22 to 32 curved chitinous hooks.
4. Inner circle with larger hooks and outer circle with smaller hooks.
5. The proximal part bears four adhesive suckers.
6. The scolex with its suckers and hooks is an organ of attachment to the intestinal wall of the host and acts as holdfast organ.

Teacher's Sign .....

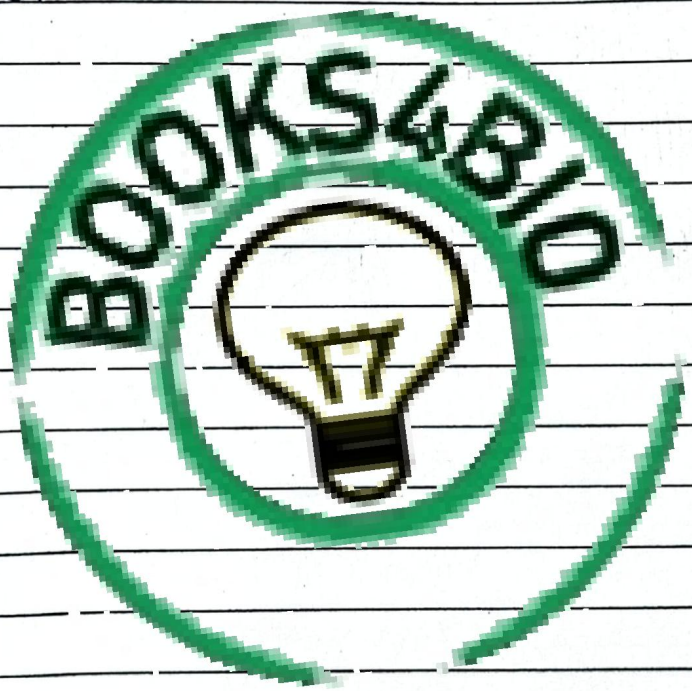


Leech : T.S passing through Crop

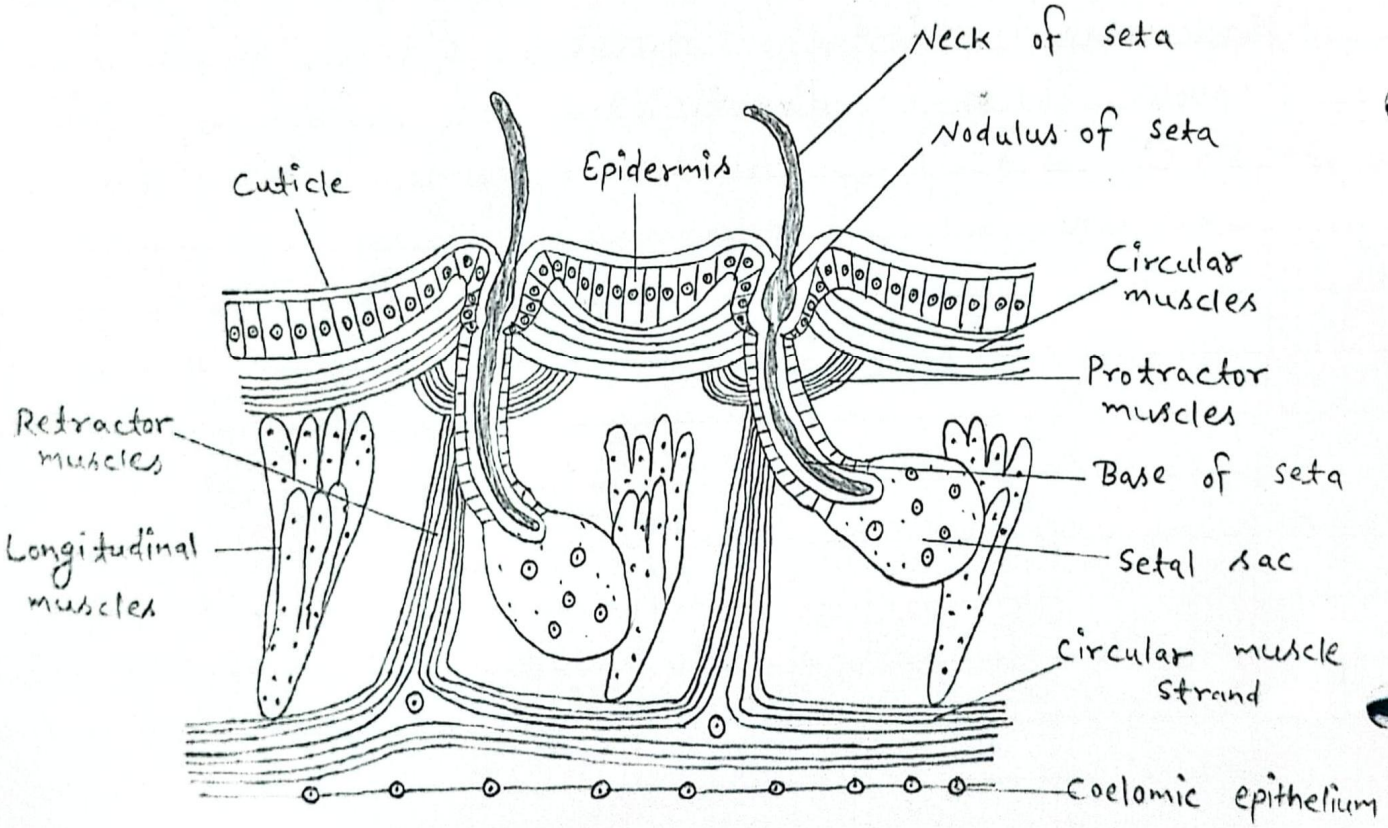
Leech: T.S. passing through crop

Date __/__/____
Page _____

1. The alimentary canal's crop is the largest part.
2. It is separated into a ten-chamber system.
3. Through circular apertures encircled by sphincters, the chambers communicate with one another.
4. Each chamber produces a pair of lateral, backwardly oriented caecae, often known as caeca or diverticula.
5. Crop's final chamber opens into the stomach.



Teacher's Sign .....



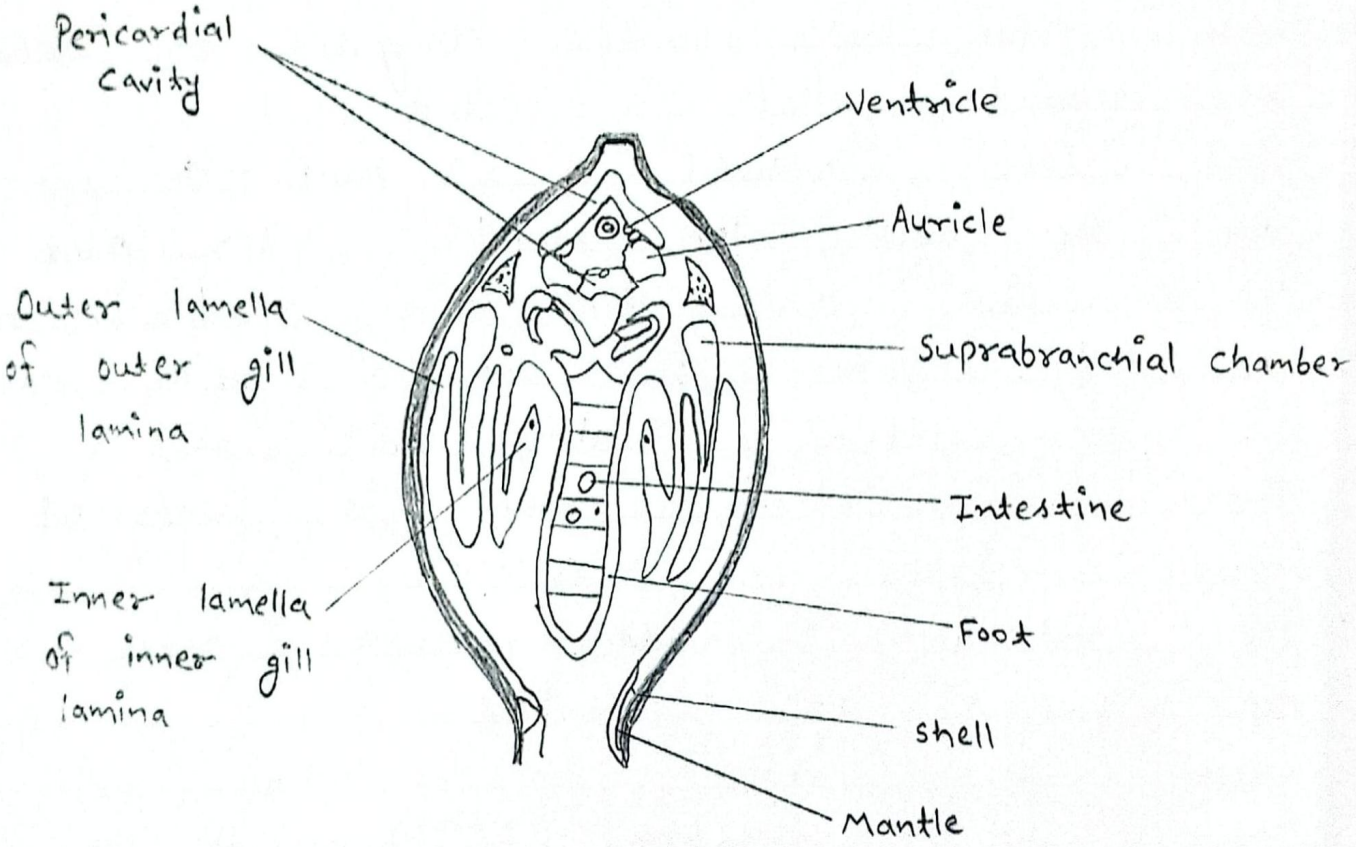
Earthworm : Setae

Earthworm: Setae

Date / /
Page

1. All segments except first, last and clitellum bears chitinous setae.
2. They lie embedded in the middle of each segment which projects backwardly.
3. About 80-120 setae are present on each segment.
4. Each setae is minute, elongated and S-shaped, and faint yellow in colour.
5. Each seta consists of 3 parts: The upper parts are the neck, the middle swollen part is the modulus, and the inner part is root or body, which is attached with setal sac or setigerous along with muscles.
6. The movement of setae is controlled by special types of muscles.
7. The clitellar segments passesses setae when the worms are immature.
8. Setae are formed of chitin.
9. Setae are arranged in annular row in the mid-ventral surface of each segment. This type of arrangement is known as perichaetine arrangement.

Teacher's Sign .....

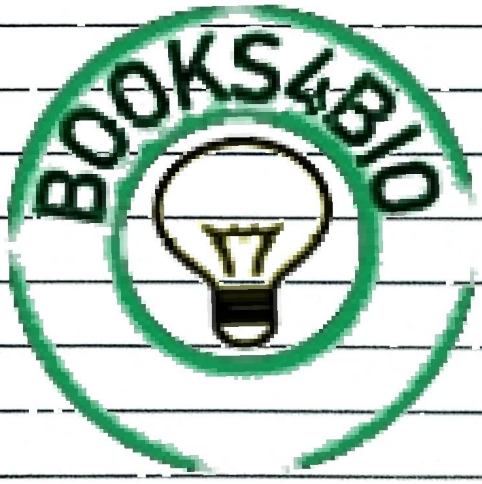


Unio: Gills T.S.

Unio: Gills T.S.

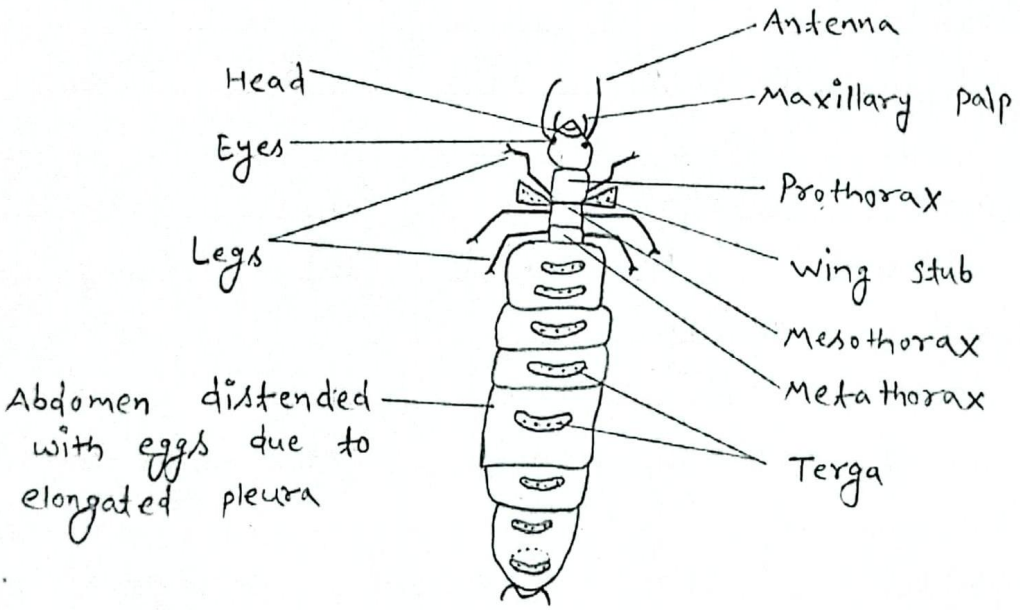
Date __/__/__
Page _____

1. The outer most layer is shell the inner surface of which is lined with mantle.
2. The foot is club-shaped and occupies major portion of mantle cavity.
3. On either side of foot lies a pair of gill laminae the inner & outer.
4. Each gill lamina is made up of two gill lamellae.
5. The gill filaments and water tubes are absent.
6. The inner lamella of inner laming is not attached to foot but hangs freely in mantle cavity.
7. The lamella of outer lamina and outer lamella of inner laming are attached to mantle.
8. The outer supra branchial chambers continue into outer gill laminae.



Teacher's Sign .....

Phylum - Arthropoda
Class - Insecta
Order - Isoptera
Genus - Odontotermes



Odontotermes (Termite)

Odontotermes (Termite)

Date __/__/__
Page _____

* Classification:-
Phylum - Arthropoda (Jointed appendages, triploblastic)
class - Insecta (Thorax with 3 pairs of appendages)
Order - Isoptera (wings are equal)
Genus - Odontotermes

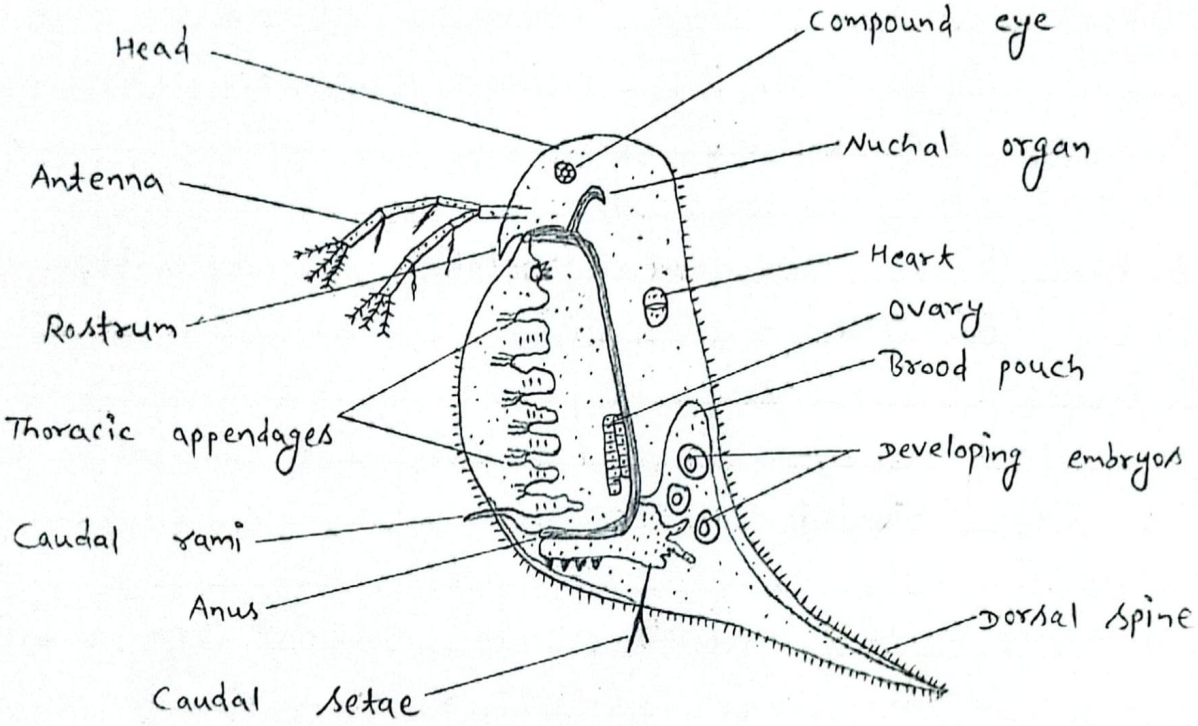
* Habitat:- Wood dwelling insects, social insect and polymorphic. The dwelling places are called 'termitarium'.

* Habit:- Feeds upon wood, vegetation, faceal matter of termites.

* Characters:-
1. The body divided into:-
(i) Head
(ii) Thorax:- 13 segments and contains 3 pairs of legs. mesothorax bears a pair of reduced wing stubs on the dorsal side.
(iii) Abdomen
2. Queen is sexually mature female and lays eggs throughout life.
3. When the power of laying eggs ceases, female dies or is killed by other members.
4. Queen's abdomen is much elongated due to increase in size of ovaries and fat bodies.

Teacher's Sign .....

phylum- Arthropoda
Class- Crustacea
Order- Cladocera
Genus- Daphnia



Daphnia

Daphnia

Date __/__/____
Page _____

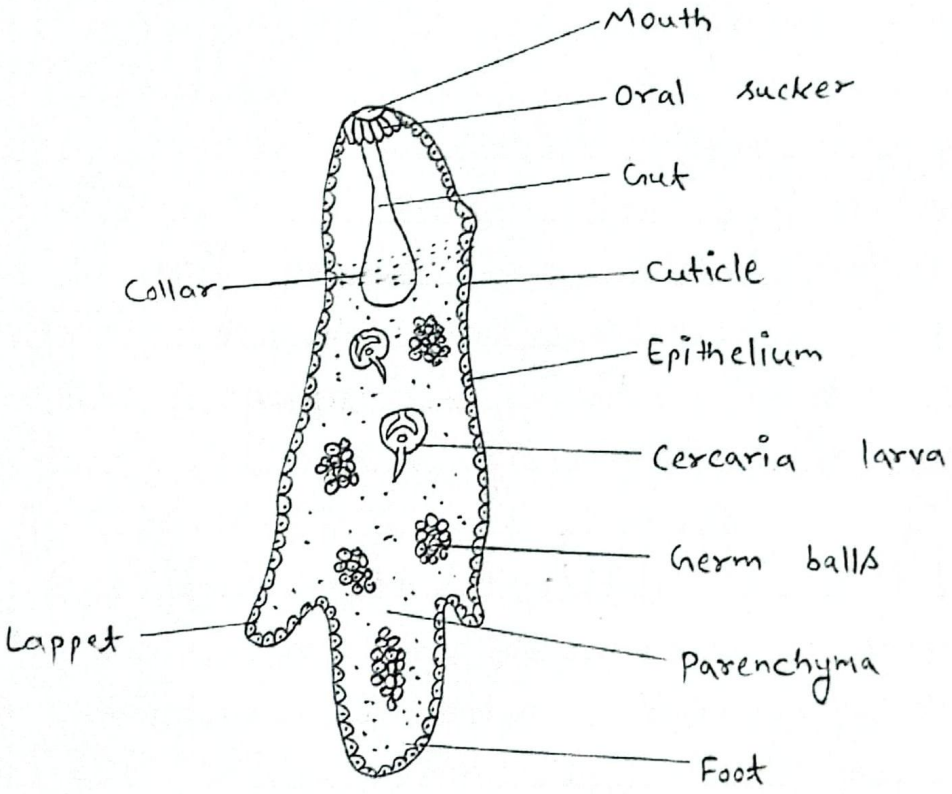
* classification:-

Phylum - Arthropoda (Jointed appendages)
Class - Crustacea (Aquatic arthropods with 2 pairs of antennae)
Order - Cladocera (Four to six pairs of thoracic limbs)
Genus - Daphnia

* characters:-

1. Commonly called as 'water-flea'.
2. Body is bilaterally compressed and enclosed in a vestigeal bivalve carapace ending anteriorly into a backwardly directed rostrum and posteriorly into a spine.
3. Head is rounded and bears large biramous antennae which help in swimming.
4. Small unjointed antennules, mandibles, maxillule and large sessile eyes are very distinct.
5. 5 pairs and leaf-like thoracic appendages are present.
6. Thoracic appendages form efficient food-catching organs.

Teacher's Sign .....



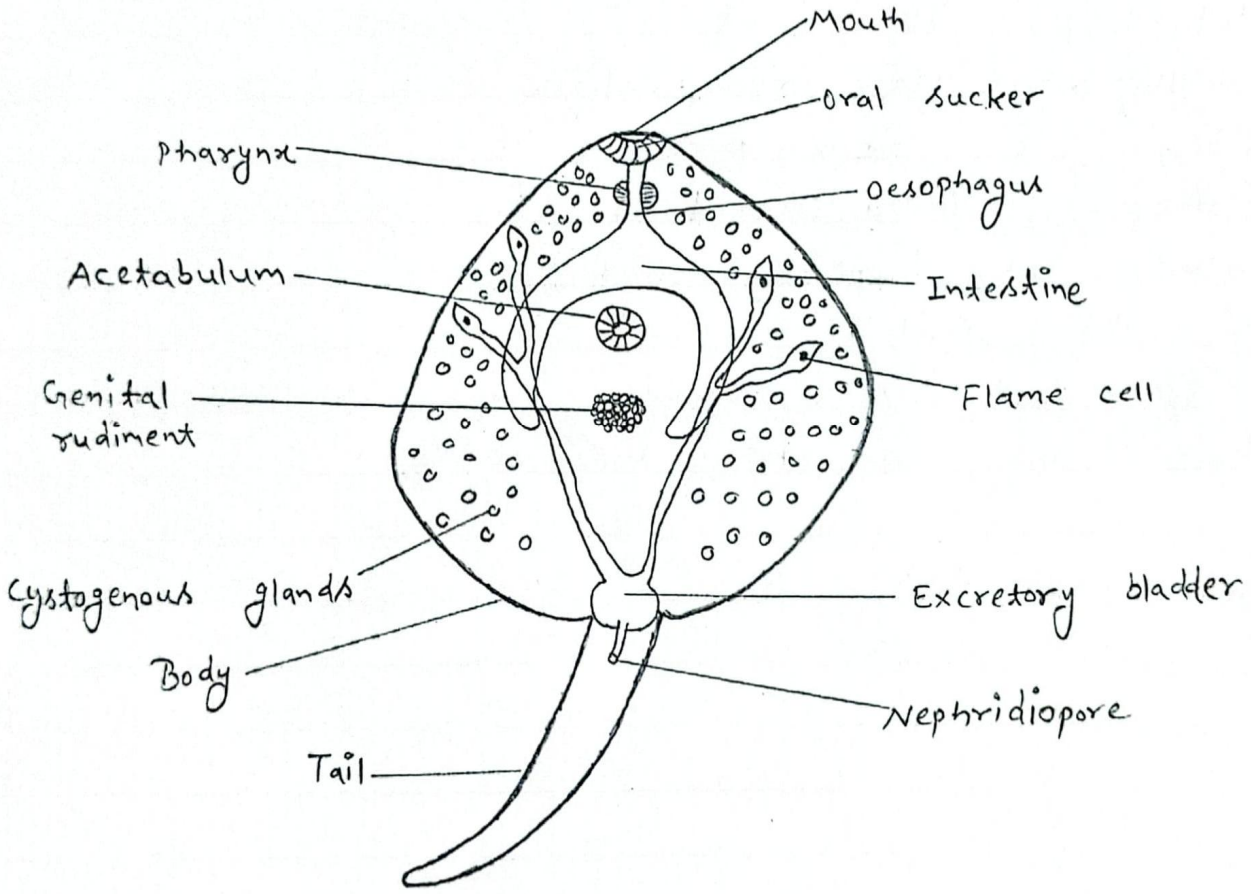
Fasciola hepatica: Redia larva

Fasciola hepatica : Redia Larva

Date __/__/____
Page _____

1. Redia larva is a third intra-molluscan parasitic larva, found in the digestive glands.
2. Germ balls, which is present in sporocyst, multiply and give rise to redia.
3. Body is elongated, cylindrical and complex in structure.
4. Anteriorly, there is a muscular ring-like swelling, called as collar. Just beneath the collar is birth pore.
5. Posteriorly, larva contains two processes near foot called as lappets, which anchor in the tissue of the snail.
6. Body wall is composed of tegument, epithelial layer and delicate mesenchyme.

Teacher's Sign .....



Fasciola hepatica : Cercaria larva

Fasciola hepatica: Cercaria Larva

Date __/__/____
Page _____

1. Cercaria larva is a free-swimming larva.
2. It has higher grade of organisation and considerably resembles the young fluke.
3. Body is oval in shape with a long simple tail.
4. Body and tail are covered with tegumental spines.
5. Tail and spines are purely larval structures meant for locomotion.
6. Body wall is composed of tegument, circular, longitudinal and diagonal muscle fibres and mesenchyme.
7. Acetabulum is present just below the fork of the intestine.
8. Flame cells present.

Teacher's Sign .....

Biostatics

Date __/__/____
Page _____

- Measures of central tendency:- I. Mean
  II. Mode
  III. Median

I. Mean:- Average, $\bar{x} = \frac{\Sigma x}{n}$

(a) Simple series:- 7, 8, 9, 6, 5, 4, 4, 8, 5, 6

$$\text{Mean} = \frac{7+8+9+6+5+4+4+3+5+6}{10}$$

$$= \frac{57}{10} = \boxed{5.7}$$

(b) Grouped data:-

(i) discrete series:-

(x)	(f)	(fx)
10	2	20
20	3	60
30	4	120
40	1	40
50	10	500
	$\Sigma f = 20$	$\Sigma fx = 740$

$$\text{Mean } (\bar{x}) = \frac{\Sigma fx}{\Sigma f}$$

$$= \frac{740}{20}$$

$$\boxed{\bar{x} = 37}$$

(ii) Continuous series:-

(x)	0-10	10-20	20-30	30-40	40-50
(f)	2	3	4	1	10
(m)	5	15	25	35	45
(fm)	10	45	100	35	450

$$\bar{x} = \frac{\Sigma fm}{\Sigma f}$$

$$= \frac{640}{20}$$

$$\boxed{\bar{x} = 32}$$

Teacher's Sign .....

Date __/__/____
Page _____

II. Median :-

(a) Ungrouped data :- 7, 3, 4, 5, 6, 7, 3

Arrange → 3, 3, 4, 5, 6, 7, 7

Median = $\left[\frac{n+1}{2}\right]^{th}$ item $\Rightarrow \frac{7+1}{2}$ = 4th item

So, **Median = 5**

For even data as 7, 3, 4, 5, 6, 7, 3, 8

Arrange → 3, 3, 4, 5, 6, 7, 7, 8

Median = $\left[\frac{n+1}{2}\right]^{th}$ item $\Rightarrow \frac{8+1}{2} = 4.5^{th}$ item

So, 4th item = 5

5th item = 6

then, Median = $\frac{5+6}{2}$

Median = 5.5

(b) Grouped Data :-

(i) Discrete series :-

(x)	(f)	(cf)
5	2	2
10	4	6
15	2	8
20	1	9
25	1	10
	$\Sigma f = 10$	

So,

Median = $\frac{n+1}{2}$

$= \frac{10+1}{2} = 5.5^{th}$ item

check in cf value b/w 5 & 6

(5.5 is b/w 2 & 6)

So, **Median = 10**

Teacher's Sign .....

Date __/__/____
Page _____

ue:- ~~Calculate the median~~

(ii) Continuous series :-

(x)	(f)	(cf)
0-10	1	1
10-20	2	3
20-30	2	5
30-40	3	8
40-50	2	10
	$\Sigma f = 10$	

$\text{Median} = \frac{10+1}{2} = 5.5^{th}$ item

check in cf value 5.5, it lies in 4th group

then, $\text{median} = L_1 + \frac{n/2 - c}{f_m} \times i$

$= 30 + \frac{10/2 - 5}{3} \times 10$

median = 30

III. Mode:-

(a) Ungrouped data:- 61, 63, 64, 69, 72, 64, 73, 72, 79, 72

frequency of 72 is high,

so, **mode = 72**

(b) Grouped data :-

(i) For having multiple mode values :-

(x)	(f)	(I)	(II) (1st skip)	(III) (pair of 2 value)	(IV) (1st skip)	(V) (pair of 3 value) (1st+2nd skip)
21	2	6				
22	4		10	12	14	
23	6					
24	4					

Teacher's Sign .....

Date __/__/____
Page _____

25	9		13				19
26	9	18			22		
27	7		16			25	
28	5	12			13		21
29	1		6			10	
30	4	5					

Let's check b/w values, xf =

I = 25, 26

II = 26, 27

III = 24, 25, 26

IV = 25, 26, 27

V = 26, 27, 28

(times) 1 4 6 3 1

26 has highest frequency of 6 so, **Mode = 26**

(ii) Continuous data:-

(x)	(f)	
31-35	3	f_0
36-40	7	f_1
41-45	5	f_2

$$\text{Mode} = L_1 + \frac{\Delta_1}{\Delta_1 + \Delta_2} \times i$$

L_1 = Lower value
i = class interval
$\Delta_1 = f_1 - f_0$
$\Delta_2 = f_1 - f_2$

$$= 36 + \frac{7-3}{(7-3)+(7-5)} \times 5$$

$$= 36 + 3.33$$

Mode = 39.33

Teacher's Sign .....

Date __/__/____
Page _____

★ Chi-square test :- Used for determining 'non-parametric values' (e.g. - Intelligence, skin colour, etc.)

Que.:-

Area	(observed) Earthworm (O)	Expected (E)	(O-E)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
1	11	20	-9	81	4.05
2	19	20	-1	1	0.05
3	26	20	6	36	1.8
4	14	20	-6	36	1.8
5	30	20	10	100	5
	100				$\Sigma = 12.70$

So, Null Hypothesis = 20

$x^2_{\text{Calculated}} = \Sigma \frac{(O-E)^2}{E} = 12.70$ $\quad \therefore x^2_{\text{Tabulated}} = 9.49$

If,

(i) $x^2_{\text{Calculated}} > x^2_{\text{Tabulated}}$ [Reject Null Hypo.]

(ii) $x^2_{\text{Calculated}} < x^2_{\text{Tabulated}}$ [Accept Null Hypothesis]

level of Significance = 0.05

degree of freedom (df)

$df = n-1$
$= 5-1$
$= 4^{th}$ Row

In this Case,
the value of x^2_{Calc} is more than x^2_{Tab} value which shows.
It rejects the Null Hypothesis.
So, the distribution is unequal.

Teacher's Sign .....

Biochemistry

Date __/__/____
Page _____

→ Qualitative and quantative analysis of biochemicals:-
(i) Carbohydrate
(ii) Protein
(iii) Fat

Experiment-I

* Aim:- Qualitative determination for carbohydrates.

* Benedict's test:-

• Principle:- They can reduce cupric ions to cuprous ion which is the basis for Benedict's reaction.

The cuprous hydroxide during the process of heating is converted to red cuprous oxide which indicates reducing sugar.

$$Cu(OH)_2 \xrightarrow{\Delta} CuO + H_2O$$

• Materials:- Burner, Benedict's solun, test tube, holder, sample.

• Method:- 1. Take 2ml of test sample in test tube.
2. Add 1ml. of Benedict's reagent and mix well.
3. Keep test tube on burner for boiling.

• Observation:- Formation of brick red/ orange precipitates.

• Result:- If show red or orange colour, then Carbohydrate is present.

Teacher's Sign .....

Date __/__/____
Page _____

Experiment - II

★ Aim:- Qualitative determination for carbohydrates.

Fehling's test:-

• Principle :-

It is a sensitive test for reducing sugars. Fehling's solun A copper sulphate and solun B is sodium potassium titrate acts as chelating agent.

Cupric oxide is reduced by reducing sugar and cupric oxide is precipitated on heating which give reddish or orange colour.

• Materials:- Fehling's solun A & B, test tubes, Burner, holder, sample.

• Method:- 1. Take 2 ml. of the test solun in test tube.
2. Add 1 ml. of fehling reagent to it.
3. Mix throughly and boil it on burner.
4. Wait for colour change.

• Observation:- Presence of red precipitate of cuprous oxide is seen due to presence of reducting sugar in the test solution.

• Result:- Presence of red / orange colour, Carbohydrate present.

Teacher's Sign .....

Date __/__/____
Page _____

Experiment-III

★ Aim:- To identify the presence of protein in a given sample.

Biuret test:-

- **Principle:-**

Proteins are large biomolecules made up of amino acids linked by peptide bonds.
Qualitative test for proteins are based on detection of peptide bonds in amino acids.
Biuret reagent reacts with peptide bonds to form a violet coloured complex.

- **Materials:-** Protein sample, Biuret reagent ($NaOH$ & $CuSO_4$ soln), test tubes, gloves, safety goggles, burner, holder.

- **Method:-** i. Take 2ml. of sample in test tube.
ii. Add 1ml. of Biuret reagent.
iii) Mix well and let it stand for 5 minutes.
iv. Observe colour change.

- **Observation:-** Violet coloured ring appeared.

- **Result:-** Violet colour indicates the presence of proteins.

Teacher's Sign .....

Date __/__/____
Page _____

Experiment - IV

★ **Aim:-** To identify the presence of proteins in a given sample using qualitative tests.

Xanthoproteic test :-

- **Principle:-** Proteins are large biomolecules made up of amino acids linked by peptide bonds. Qualitative tests for proteins are used for detection of these peptide bonds in amino acids. Aromatic amino acid react with concentrated nitric acid to form yellow nitro derivatives.

- **Material:-** Sample soln, Conc. HNO_3, test tubes, Burner, gloves and safety goggles, holder.

- **Method:-** (i) Take 2ml. of protein sample in test tube.
(ii) Add a few drops of Conc. HNO_3
(iii) Carefully heat until it boils.
(iv) Wait and observe it.

- **Observation:-** The appearance of orange or yellowish coloured solution takes place.

- **Result:-** This colour change indicates the presence of protein in given sample.

Teacher's Sign .....

Blood Physiology

Date __/__/____
Page _____

★ Blood group identification :-

- **Object :-** Identification of ABO blood group and Rh factor in human blood.

- **Principle :-** According to Karl landsteiner on the basis of absence of A or B antigens or presence of them in red blood cells.

- **Apparatus & chemicals :-** Cavity slides, blood sample vials or small glass tubes and antiserum (A, B, D), pathological binocular microscope.

- **Procedure :-**

(i) Take sterilized cotton wet in 90% alcohol.
(ii) sterile and dry tip of finger and then prick it with a sterilized needle.
(iii) Collect blood sample vial containing 1ml. of 0.85% sodium chloride (0.85 gm of sodium chloride powder dissolved in 100cc of distilled water).
(iv) Take 2 cavity slides wash and clean them and let the slides dry.
(v) Add a drop of sample of blood in each cavity.
(vi) Now add a drop of antiserum (A, B and D) seperately in cavities.
(vii) Mix the blood sample with a sterilized needle.
(viii) Leave for 2 minutes and observe.

Teacher's Sign .....

Date __/__/____
Page _____

- Observation:—

Blood group / sera	Anti-A	Anti-B	Anti-D
O^-	Normal	Normal	Normal
O^+	Normal	Normal	clumping
A^-	clumping	Normal	Normal
A^+	clumping	Normal	clumping
B^-	Normal	clumping	Normal
B^+	Normal	clumping	clumping
AB^-	clumping	clumping	Normal
AB^+	clumping	clumping	Clumping

- Result:— Blood group is AB^+.

Teacher's Sign .....

Cell Biology

Date __/__/____
Page _____

★ Aim:- To perform and identify different stages of mitosis in onion root tip.

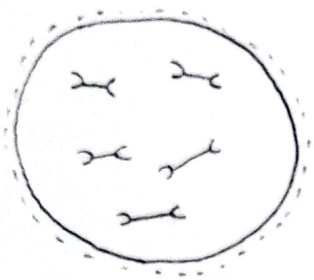
- Objectives:- To identify stages of mitosis in onion root.

- Principle:- Onion root tip has meristematic tissue just behind the root cap, hence this serves as a good material for studying various stages of mitosis.
  The process of mitosis is mainly divided into four stages :- (i) Prophase (ii) Metaphase
  (iii) Anaphase (iv) Telophase

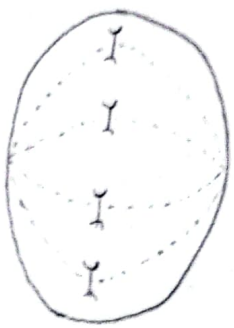
- Apparatus, Glassware & chemicals :- Root tips of onion, spirit lamp, needle, slide, cover slip, watch glass, forceps, dropers etc., FAA solution, 1N HCL, Acetocarmine stain.

- Pre-preparation :- First take 2-3 onion and place them on a glass of water without dipping in the water, place the glass in slightly dark place and study it daily, when the young roots are about 2-3 mm long, then cut 2-3 mm of the root apex and arrange in a small bottle in which FAA solution is present. FAA solution is made from foraline acetic acid and 90% alcohol are mixed in equal proportions.

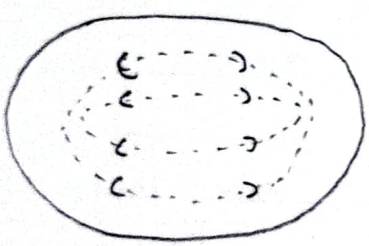
Teacher's Sign .....



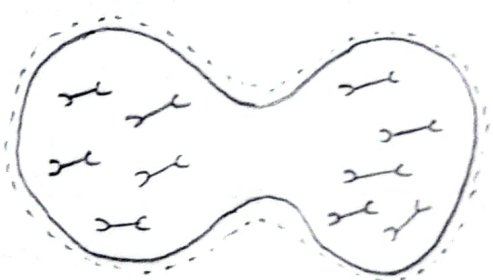
(i) Prophase



(ii) Metaphase



(iii) Anaphase



(iv) Telophase

Stages of Mitosis

Date __/__/____
Page _____

- Procedure :- (i) Take out 2-3 piece of root tips kept in FAA, place them in watch glass and wash them with water.
(ii) Now place root tips on slide and add few drops of 1N HCl on them. Heat the slide on low flame with a needle, it can also be teased.
(iii) Now put a few drops of acetocarmine stain on the material and heat the slide.
(iv) After sometime cover the material with cover slip.
(v) Press the cover slip lightly.
(vi) observe it under compound microscope in 10x view.
(vii) Scan and narrow down to region containing dividing cells.
(viii) switch to 40x for a better view.

- Observation and calculation:- Observe slide first under low power and then high power, find the stages of Prophase, metaphase, Anaphase & Telophase. Compare them with their structures.

- Result :- Different stages of mitosis can be seen.

- Precautions:- (i) Use freshly prepared chemicals.
(ii) Always clean glassware in experiment.

Teacher's Sign .....